Dream, though dreams won't be realized,
Fight when outgunned,
Search for overwhelming tasks
and live to the end of time

НАЦІОНАЛЬНА
АКАДЕМІЯ НАУК УКРАЇНИ
ІНСТИТУТ ПРОБЛЕМ МАТЕРІАЛОЗНАВСТВА
ім. І.М. ФРАНЦЕВИЧА

СПОГАДИ ПРО Г.В. САМСОНОВА

УЧЕНИЙ
ОРГАНІЗАТОР
УЧИТЕЛЬ

ПРОЕКТ
«УКРАЇНСЬКА НАУКОВА КНИГА
ІНОЗЕМНОЮ МОВОЮ»

КИЇВ
АКАДЕМПЕРІОДИКА
2018

COLLECTION OF MEMORIES ABOUT G.V. SAMSONOV

NATIONAL ACADEMY
OF SCIENCES OF UKRAINE
I.M. FRANTSEVICH INSTITUTE FOR PROBLEMS
OF MATERIALS SCIENCE

SCIENTIST ORGANIZER TEACHER

*PROJECT
«UKRAINIAN SCIENTIFIC BOOK
IN A FOREIGN LANGUAGE»*

KYIV
AKADEMPERIODYKA
2018

UDK 669.018
S40
doi: https://doi.org/10.15407/akademperiodyka.349.156

Editors:

M.A. VASILKOVSKA, *V.I. IVASHCHENKO* (deputy chief editor),
V.V. SKOROKHOD (chief editor), *O.B. PAUSTOVSKYI*,
I.I. TIMOFEYEVA, and *T.M. YARMOLA*

Original edition (in Russian)

Г.В. Самсонов – ученый, учитель, друг (G.V. Samsonov as a Scientist, Teacher, and Friend)
G.V. Samsonov – uchenyi, uchitel, drug. – Kyiv : Naukova Dumka, 2012. – 190 p.

Revision and translation *T.M. YARMOLA*

Approved for publication by the Bureu of the Department of Physical and Technological Problems of Materials Science of the National Academy of Sciences of Ukraine (September 26, 2017, Protocol № 12)

Publication was funded in the frame of the Targeted Complex Program "Creation and Development of Scientific Publishing Complex of the National Academy of Sciences of Ukraine"

S40 **Scientist,** organizer, teacher. Collection of memories about G.V. Samsonov / National Academy of Sciences of Ukraine, I.M. Frantsevich Institute for Problems of Materials Science. — Kyiv : Akademperiodyka, 2018. — 156 p.

ISBN 978-966-360-349-0 (eng.)
ISBN 978-966-00-1244-8 (rus.)

The book is devoted to the memory of the famous scientist, talented organizer and teacher, Corresponding Member of the National Academy of Sciences of Ukraine Grigorii Valentinovich Samsonov. The memories of his students, colleagues, and friends illuminate the invaluable role of G.V. Samsonov in the development of the fundamentals of materials science, education of young scientists, and creation of a powerful scientific school, fruitfully working to date.

The book will be of interest for experts in the field of materials science and for all those who are going to serve science and like eminent and extraordinary personalities.

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ISBN 978-966-00-1244-8 (rus.)

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Samsonov has shown
How to serve science:
Not searching for prizes,
Not sleeping of boredom.

E.N. MARMER,
Academician of RANS

FOREWORD

In February 2018, we are going to commemorate the centenary of the birth of Grigorii Valentinovich Samsonov, a Corresponding Member of the National Academy of Sciences of Ukraine, a prominent scientist in the fields of crystallochemistry and the physicochemical fundamentals for synthesis and properties of practically all classes of refractory compounds, such as borides, carbides, nitrides, hydrides, silicides, aluminides, phosphides, germanides, and antimonides of transition and nontransition metals as well as nonmetallic refractory compounds of boron and silicon, and the creator of a scientific school.

The studies carried out under Samsonov's leadership, related to the clarification of the nature of refractory compounds, mechanisms of processes running during their synthesis and processing, and substantiation of the dominant role of the electronic structure in the formation of physical, chemical, and technological properties of materials, have made a significant contribution to the theory of material creation on the basis of the electronic structure as well as to to the scientific classification of refractory compounds.

Over 400 refractory compounds of constant and variable composition were obtained and studied under his supervision. On this basis, technological methods for manufacturing products for industrial application, operating at high and ultrahigh temperatures, were developed.

The work of representatives of the scientific school founded by G.V. Samsonov led to the development of industrial technologies for obtaining a huge number of various refractory compounds and to widespread use of new materials and coatings based on them, the production of which was arranged in a number of workshops and sites at many enterprises in Ukraine and the former USSR. About 100 certificates of inventions were obtained. For this work, G.V. Samsonov was awarded the State Prize of the USSR and the Prize of the Academy of Sciences of the Ukrainian SSR named after Ye.O. Paton.

Grigorii Valentinovich was the initiator and leader of researches carried out in many institutions and organizations of the former USSR and a number of other countries (formerly Yugoslavia, Bulgaria, Czechoslovakia, and Poland) in the area of the theory and technology of materials based on refractory compounds, high temperature materials and coatings, as well as materials synthesized under high pressure conditions. These works created a base for subsequent directions of theoretical and applied works, for example, the development and introduction into industry of technology for manufacturing graphite-like boron nitride, became a base for obtaining its dense modification, a new promising superhard material.

For the outstanding achievements in the theory of hard alloys and refractory metals, the International Planseeplaket Society awarded G.V. Samsonov the Plansee medal, the highest international award in this field.

Grigorii Valentinovich Samsonov possessed an outstanding pedagogical talent. He was the founder and head of the department of high temperature materials and powder metallurgy at the Kyiv Polytechnic Institute (KPI). With a special great attention, kindness, and demandingness he trained his numerous graduate students.

G.V. Samsonov spent great educational activities, promoting scientific knowledge in the post of Rector of the Kyiv People University of Technical Progress. For this active work he was presented with a medal named after Academician C.I. Vavilov.

G.V. Samsonov left a huge scientific heritage. It includes over a thousand scientific articles and over forty monographs and reference books, many of which have been translated into other languages and reprinted abroad. Until now, G.V. Samsonov's publications have had one of the highest scientific citation indices in the world.

Today, materials science and technology for obtaining refractory compounds, the lifework of the eminent scientist G.V. Samsonov, remain cornerstones of the scientific foundation, on which houses the Institute for Problems of Materials Science of NAS of Ukraine.

The book is a collection of memories which will be of unquestionable interest, especially for those who seek their path in science and are interested in outstanding personalities.

V.V. SKOROKHOD
Academician of the NAS of Ukraine

THE WORD ABOUT G.V. SAMSONOV

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Once one thinker noticed that a scholar's works may be more significant than his personality. But sometimes a personality is more majestic than his labor. Speaking of Grigorii Valentinovich Samsonov, it is impossible to give preference to one or the other, as Samsonov was a surprisingly integral man. He possessed a combination of such personal traits which, if considered, may turn out to be polar. But their apparent polarity created a rare internal harmony. No doubt, Samsonov, in many ways and for many people, was one of the most interesting personalities. He stood out for his romantic devotion to science and public debt. His love for science was boundless. And he was always in search for innovative things. Consequently, his life in science proved to be meaningful, instructive, and fruitful.

Our first meeting took place in the 1930th, when I, aged 26, was Director of Moscow Institute of Fine Chemical Technology (the youngest director of an educational institute in the former USRR), and Samsonov was a first year student who had entered the Insitute after successfully passing entrance exams with top grades. The matter was that he was enrolled by mistake: the legal age for enrollment was eighteen whereas Samsonov was seventeen. Thus I was to expel him from the Institute. The next year he took exams again and entered the Institute. He used to recall this episode with the words, "What do you think I learned then? The day of my expulsion taught me to ever hate administration and silly official instructions."

G.V. Samsonov was born in the town of Pushkin near Saint-Petersburg. Yet in his youth he closely approached the richness of the Russian culture against the background of turbulent and vivid events of the first post-revolution years.

His father was a metallurgical engineer, then an associate professor, one of the representatives of the Russian intelligence. Young Samsonov took a lot from his father, in particular his interest in science.

At school and then at Moscow Institute of Fine Chemical Technology, Samsonov was markedly notable for his knowledge and outstanding abilities. His student years (1935-1940) coincided with the birth of powder metallurgy as a science.

In the period 1940-1947, Samsonov was an engineer-researcher, an officer of the Soviet Army, and an active participant in World War II, awarded some military awards. On returning to peaceful life, he entered the graduate course at Moscow Institute of Nonferrous Metals and Gold. His scientific advisor was Professor G.A. Meerson, whom he kept close ties with over the whole life. During his graduate studies he found time to attend lectures on new aspects of higher mathematics and physical chemistry held at the Moscow University. He could also be seen listening lectures on philosophy and engineering.

After defending his candidate dissertation, he worked as a senior researcher and an associate professor at the same institute (1950-1956). In these years Samsonov was formed as a mature scientist and lecturer.

The following years of Samsonov's life (1956-1975) were tied with Kyiv. It is the Kyiv period that is the prime of his creative activity. He held the position of Deputy Director for scientific work at the Institute for Problems of Materials Science (IPMS) (formerly Institute of Cermets and Special Alloys of AS of the Ukrainian SSR). In 1963 he organized and almost till the end of his life headed the department of high temperature materials and powder metallurgy at the Kyiv Polytechnic Institute (KPI). In 1957, Samsonov successfully defended his doctoral dissertation entitled "Some physical and chemical characteristics of compounds of transition metals with boron, carbon, nitrogen, and silicon." In 1959, Samsonov was awarded the academic rank of Professor and two years later was elected Corresponding Member of the Academy of Sciences of the Ukrainian SSR.

Samsonov was a scientist with a keen sensitivity to everything emerging in the rapidly changing world of science. That is why he was always at the forefront of science, at the very sources of a number of scientific trends and important areas of research. With exceptional pedantry, he followed the domestic and world literature, strictly systematized new information, and willingly shared it with his students and employees. He was a generator of scientific ideas and, essentially, he himself and his associates sought to implement them in engineering. Bold, restless, not reconciled with stagnation in science, he was fully regarded as an unquestioned authority in the areas of materials science and powder metallurgy.

Samsonov's encyclopedism was expressed not only in the breadth of his interests, but also in the depth of his insight into the mechanism of those theoretical and technological problems that attracted him. Samsonov was also interested in social and human sciences, he was fond of painting, poetry (even had a poetic gift), philosophy, and history, in particular the history of science and technology. For many years Samsonov successfully headed the section of the history of metallurgy, initiated the creation of the fundamental work "History of Inorganic Materials Science", published a number of articles on the history of powder metallurgy and scientists' biographies, and spoke at international conferences on science history.

Samsonov never avoided scientific arguments, never was embarrassed when he met a negative attitude toward his ideas. He bravely clashed against his opponents and believed that discrepancy among scientists is hidden in the very nature of science as a non-stop process of search for the truth. Samsonov considered scientific polemics useful, even necessary.

Another his characteristic trait should be mentioned: however high Samsonov valued scientific knowledge, it was for him inseparable from human needs and social life. Science, society, and man were perceived as inseparable things.

Attention to people, close and distant, was no less acute than interest in scientific problems. He helped many people and did it daily, sparing neither effort nor time.

The synthesis of such contradictory qualities as courage and tenderness, humor and rigor, logic and imagination, firmness of conviction and selfcriticism, orientation toward practice, and, at the same time, abstractive approaches determined Samsonov's identity. All this may be added with his extraordinary love for nature, for animals, birds, and flowers.

Samsonov is an author of more than forty monographs, generalizing both his own works and then available information on refractory metals and compounds. Some of his books were reprinted in English, German, Polish, Serbian, Romanian, Czech, French, and Japanese. Each of his books is inherent in brevity and clarity, serves as a creative approach to the examination of problems, and represents the essence of phenomena described.

The traces of his work as an organizer of science are visible in many ways. His bright organizational talent was especially revealed in his founding new laboratories, preparing collective publications, holding scientific conferences and seminars, where his new ideas, broad initiative, effort and energy were needed to the greatest extent. Those who watched him were usually amazed: from where does this man, immersed deeply in theory and experiment, draw his ideas and how does he manage to inspire people to implement his plans in life?

Samsonov was the creator of a large scientific school. Here his authority (not only scientific, but also moral) was indisputable. His "legacy" includes over 150 candidates and 12 doctors of sciences trained and brought up for science. This is a convincing fact! Many hundreds of students, future engineers, listened to his lectures, handed him tests, and took exams. Many students of his former students have already successfully debuted on the stage of science. Samsonov deserves their great thanks. With his own example, Samsonov taught students and collaborators to love science, in particular to understand the spirit and ethics of science. His call to hold high the banner of science is today as a direct testament.

Surely, Samsonov belongs to the number of gifted and versatile figures. His multifaceted talents, wide erudition together with a strikingly lively character, and, at the same time, inner softness formed the basis of his personality. He wonderfully combined (what is so rare!) talents of an engineer, a thorough experimenter and a thoughtful theorist.

Although there is an opinion that a present-day scientist cannot simultaneously cover a wide range of scientific problems because of the science differentiation, Samsonov actively participated in almost all the major trends of materials science and powder metallurgy. Over the quarter of century, he touched a great deal of different scientific issues and never stopped halfway. His mind was always inclined to work on new problems like on "*virgin soil*". Enthusiasm for science, and permanent aspiration for the discovery of the scientific truth were inherent in his character.

Samsonov's scientific style was characterized by a distinct practical orientation of his research, *i. e.*, by desire for possibly more rapid implementation of experimental results into practice.

We can definitely say: there is almost no area in powder metallurgy and materials science where his participation, direct or indirect, could not be visible, where his ideas did not affect its development.

It is possible to distinguish three interconnected stages of his scientific activity, each of which has its own peculiarities. The first stage includes chemical and technological works, which attracted large teams of researchers and received the greatest recognition. Samsonov's initial publications became a start for his subsequent diverse studies. His first article "Ferroalloys of tungsten and molybdenum" is dated 1949. A year later, he published the articles entitled "On the issue of obtaining boron single crystals" and "Determination of free carbon content in boron carbide" in the genre of "pure" technology.

The next stage includes the analysis of the "composition-property" relationship. Samsonov was convinced that methods of physical and chemical analysis, to which he attached great significance as to instruments for the creation of new materials, may make it possible to determine the material "technology" (chemical composition, methods for production, possible composites) from the prior conceived complex of physicochemical properties. This was reflected in such publications as "Microhardness of borides and nitrides of refractory metals" (1952) and "Physicochemical properties of some interstitial phases" (1953), which highlights the functional dependences in the relationships "technology — property" or "composition – property".

In further research, along with the notions "technology" and "properties," Samsonov used the category "structure" as a basic characteristic which allows one to answer the questions not only "how", but also "why". The use of this category should be considered as the beginning of the third, the most fruitful, stage of his scientific activity. In order to eluciate the nature of materials as clearly and deeply as possible, Samsonov concentrated his attention on the electronic structure. According to the evidence of one of the closest and talented Samsonov's students, Dr. L.F. Priadko, in the last years of his life, Samsonov underlined that the study of materials should be carried out in three stages: i) at the level of imperfections in the crystal; ii) at the level of the crystalline structure, and iii) at the level of the electronic structure.

In this structural hierarchy, the electronic structure occupied a special place in Samsonov's works and attracted his close attention as a technologist. Samsonov said that he combined a technologist, whose ultimate goal is material itself, and a researcher, who is interested primarily in the "working principle" of the material. Thus, in the course of Samsonov's scientific activity, a shift in scientific interests occured from "pure" technology toward the theory of physical and chemical properties and further to the structure of materials.

He was one of the first to conduct a comprehensive study of methods for obtaining extensive classes of refractory compounds. The study was carried out in the following directions: i) research and development of methods for production of powders of refractory compounds; ii) study of a complex of their physical and chemical properties, and iii) research and development of methods and technologies for the formation of products from them, and iiii) search for areas of their possible application.

Samsonov studied methods and elaborated technologies for obtaining numerous compounds such as borides, carbides, nitrides, hydrides, silicides, phosphides, and germanides of transition, alkali and rare-earth metals, as well as nitrides of boron, aluminum, and silicon. In total, he with his associates developed more than 400 refractory compounds. On their basis, industrial production of powders of various refractory compounds was organized.

It is rather a rare case in the history of science when one researcher with his employees could create such a number of compounds and control the entire process from laboratory experiments to implementation them in industry.

Samsonov's contribution to the development of methods for fabrication of articles of various shapes from refractory compound powders is significant. For the first time, he developed techniques for manufacturing a great deal of articles. Furthermore, he created a theoretical basis for pressing and sintering powders, for physicochemical processes running in hot pressing, extrusion forming, casting, and reaction and activated sintering. Searching for new materials with special properties and new applications, Samsonov studied complex systems of multicomponent compounds, such as carbonitrides, carbohydrides, *etc*., which markedly expanded the range of characteristics studied. He obtained data which are important for researchers and not less important for engineers: on electrical conductivity, thermoelectromotive force, Hall's effect, magnetic behavior, radiation coefficients, vapor pressure, non-metal-in-metal diffusion parameters, catalytic thermoemission, crystal structure, microhardness, friction, wear, abrasion, *etc*. at various temperatures.

Samsonov developed theoretical fundamentals, technology, and design for the following products: high temperature thermocouples allowing temperature measurement up to 3000 °C for a long time; cathodes from rare earth metal borides for electronics, high temperature heaters from molybdenum silicides, heat-resistant refractory alloys, materials for high temperature technology, *etc*. The methods for diffusion welding of refractory compounds, electrospark processing, and electronic alloying should also be mentioned. He first developed cermet neutron absorbers, new types of drilling tools and surfacing alloys, protective jackets, resistors, and so on.

All that allows us to raise a question of creating a "bank of constants". In this regard, single crystals were of his great interest. The study of their properties is essential in understanding the nature of matter, the nature of chemical bonding and properties.

Samsonov's works in the field of fine inorganic synthesis were very extensive. His attention, for example, was attracted by new materials with high heat-resistant properties, namely beryllides. Under his leadership, beryllides of rhenium, titanium, chromium, and boron were obtained. In 1966, Samsonov wrote in his monograph "Beryllides", "One of the promising high temperature materials are compounds of metals and nonmetals with beryllium, the so-called beryllides, characterized by high operation temperatures, relatively low density, and specific properties." And further, "Taking into account the peculiarities of the beryllium atom, it is possible to conclude that the electronic structure of beryllides is also of considerable interest."

Samsonov initiated synthesis and investigation of properties of selenides, tellurides, and polonides. In the 1960th, his first works on the methods for preparation, properties, and industrial application of chalcogenides appeared. He wrote, "The physical and chemical properties, as well as the crystalline and, partly, electronic structure of chalcogenides, have been studied to such an extent that principles of their scientific classification may be suggested". His ideas have been justified: a great deal of complex chalcoge-nide compounds having semiconductor properties is under study today. Also, great success accompanied his work on the synthesis and investigation of the properties of phosphides.

Samsonov did much for the development of inorganic synthesis. A dream of his was to write a book on preparative chemistry of refractory compounds of all classes. Unfortunately, he did not have time to do this.

Finally, let us dwell on the studies of the third stage, that is, on the works that particularly fascinated him. He sincerely believed in their success. They gave him the needed strength to generate new ideas. We mean the creation of scientific foundations for physical materials science, namely the configuration model of the electronic structure of matter. This model is a result of his almost two-decade creative scientific activity.

Samsonov was of belief that the concept of configuration electron localization practically works much better than the one-electron-band model, for it satisfies the materials science criterion of universality. His views on the difference in the electronic structure of polymer modifications of elements were directly confirmed in experiments of domestic and foreign researchers using titanium, zirconium, iron, cobalt, and cerium as examples. These ideas, like the ideas of the atomic and band theories, were formed in parallel with different countries, in different forms, and at different theoretical levels. Distinguished by simplicity, the model made it possible to explain various properties of substances and various polymorphous modifications in terms of the electronic structure of atoms. For the first time, in journals and in reports, Samsonov opposed to excessive redundancy of the one-electron-band theory and emphasized the theoretical legitimacy and practical utility of the atomic and configurational approaches, which, in his opinion, were adequate as well, but in many cases were more convenient for use, especially in materials science. Samsonov established relations between many physical properties of refractory compounds and their electronic and crystal structures on the basis of the proposed criterion of incompleteness of electronic shells in transition metal atoms. In particular, theories of thermoemission, thermal, thermochemical, and electrophysical properties of refractory compounds were developed based on his model. For the first time, he proposed a scientific classification of refractory compounds in terms of their electronic structure.

All the above allowed laying the fundamentals for the theory of refractory compound properties and finding practical solutions to problems of forecasting, that is, creating compounds with predetermined properties (for example, corrosion-resistant, heat-resistant, semiconductor, and catalytic ones), including a number of new refractory cermets. "The task of predicting material properties", Samsonov wrote, "amounts to describing the basic features of the material electronic structure."

At Samsonov's lectures and reports, questions often arose, "Can it be possible to foresee the properties of materials?", "Can there be a way to get new desirable materials?" and the like. Samsonov firmly answered: yes, we can!

Only a far-sighted scientist, scientist-encyclopedist, scientist-innovator like Samsonov could put forward such ideas, develop them, improve, propagate, defend, and implement in practice.

Samsonov experienced a genuine joy when he saw among the supporters of the configuration model of matter not only experts in the field of powder metallurgy, but also well-known academicians working in other areas of science.

I attended the report presented by Samsonov to the Presidium of Academy of Sciences of the USSR on March 20, 1975, entitled "Scientific principles for obtaining inorganic materials with desired properties". He began his presentation with the words, *"Today technical advancement is based on energetics, automation, and materials, and the latter occupy a specific position, as the development of energetics (particularly new production methods and energy transmission) and automation would be impossible without implementation of new materials which meet today's complex requirements."* He spoke for thirty five minutes instead of twenty allotted to each speaker according to the rules of procedure. Samsonov spoke fluently, calmly, did not read a single word.

The most interesting contributions to the discussion were made by Academicians of RAS I.P. Alamarin, M.G. Basov, P.L. Kapitsa, A.V.Fokin, and Corresponding Member of RAS E.M. Savitskii. They emphasized the urgency of the problems discussed and praised the report highly for bringing forward important theoretical and technological challenges. In short, the report was a great success.

Samsonov came to my place the same day and our talk turned to the meeting. In reply to my congratulations, he said, "We should speak of the success of my report after some of my proposals have been tested on inorganic materials, but I do not deny that it gives me pleasure to know that my theoretical views have been acknowledged, otherwise my presentation would have been like the appearance of a provincial singer performing in the capital for the first time."

Samsonov's scientific studies dealt with sixteen different problems of materials science and powder metallurgy. On them, more than 1000 articles were published in journals and encyclopedias, 42 monographs and 6 reference books were issued, about 80 copyright certificates were obtained. Under his editorship 59 books and proceedings were published. Samsonov's works attracted experts from different countries (11 books and over 80 articles by Samsonov were published abroad).

It is interesting to trace the problems concerned in his publications: the greatest number of works (220, including 8 monographs and reference books) is devoted to the physicochemical properties of refractory compounds. The second position is occupied by works related to the technology of refractory compounds (140, including 6 monographs and 15 author certificates). Further positions are as follows: 130 works (including 46 copyright certificates) on powder metallurgy, new materials, and their application; 94 works on diffusion processes, alloying, and modification of alloys; 82 works (including 12 books) on crystallochemistry of refractory compounds and polymorphism; 65 works on the electronic structure and chemical bonding: 60 works on sintering and pressing; 60 works on the mechanical properties of refractory compounds; 55 works on chemical stability and chemical reactions during hydrogenation and catalysis; 17 publications in the field of refractory coatings, phase diagrams, phase transitions, thin films, surface properties, wetting, *etc.*; 8 papers on general problems of the history of science and the history of powder metallurgy.

Samsonov aspired to expand international scientific contacts in every possible way. He was an organizer of the reissue in the USSR and the editor of works of the renowned scholar President of the Serbian Academy of Sciences and Arts P. Savich. There was neither a period of time, nor an important event in the life of the International Institute for the Science of Sintering (Belgrade) that was not connected to the name of Samsonov, his initiative and new ideas. For example, he took an active part in the creation of the statute, formation of programs of symposia and conferences, and preparation of scientific paper publications. The fact that the Institute shortly became a true center of the international science of sintering is a great personal achievement of G.V. Samsonov.

Many years of joint research connected him to Polish scientists, in particular to the author of classical works on powder metallurgy President of the Polish Academy of Sciences V. Tzebyatovskii as well as to many scientists of the former GDR, Bulgaria, Hungary, Czechoslovakia, the USA, France, Holland, Finland, *et al.* Samsonov was a member of the editorial boards of a number of Soviet and foreign (Italian, German, French, Serbian) journals.

His scientific works received international recognition. He was awarded the Plensee Medal (1968) for outstanding work on powder metallurgy and metal physics. The Serbian Chemical Society elected him Honorary Member (1971). For an exceptionally great contribution to the strengthening and development of the International Institute for the Science of Sintering, G.V. Samsonov was posthumously elected its Honorary Member (1976). He received the title of Honorary Citizen of Vienna Higher Technical School (1948) and Honorary Worker of Science and Technology of Ukrainian SSR (1968). In 1972 he was awarded the title of Laureate of the State Prize. He was also recognized with the following awards: named after D.I. Mendeleyev, P.G. Sobolevsky, Ye.O. Paton; gold and silver VDNH medals. For his long and many-year enlightenment activity in popularization of scientific knowledge in the post of Rector of Kyiv People University of Technical Progress, Samsonov was awarded a medal named after Academician S.I. Vavilov.

Samsonov's works, including hot pressing, diffusion welding, and automation of metallurgical processes have been repeatedly referred to till today.

It is hard to believe that, in our age of total specialization, one person could be engaged in all these so diverse and, at the same time, urgent problems, and in such a wide range. This may be explained not only by Samsonov's giftedness, exceptional diligence, and bright talent, but also by his special organizational abilities. He had a rare ability to attract young scientists, to entice them with his ideas, versatile knowledge, to trust and inspire confidence in himself, to encourage initiative, to form a creative atmosphere. He attracted people with his personal traits: bright ideas, high general culture, curiosity, fidelity to principles, and pedagogical tact. Many experts of various ages from various cities, research and higher educational institutions willingly cooperated with him. He was always pleased with discovery of new talented scientists, especially among young people.

Samsonov knew and loved literature, poetry, and art. His library contained over five thousand books not only in Russian and Ukrainian, but also in Polish, Serbo-Croat, Czech, German, English, and French (he was fluent in German and could understand the other languages). He regularly subscribed to newspapers from Belgrade, Warsaw, and Prague). The library showed up him to be a man thirsty for knowledge with broad interests. He never could stand dilettantism, his literary tastes were very definite. He particularly loved Russian and foreign classics, realism in both literature and art. He knew by heart many verses of Pushkin, Rilskyi, Mickievicz, and many others. Despite his extreme pressure of work, he always found time to visit art galleries, to roam around the old streets of Moscow, and, of course, to browse around bookstores.

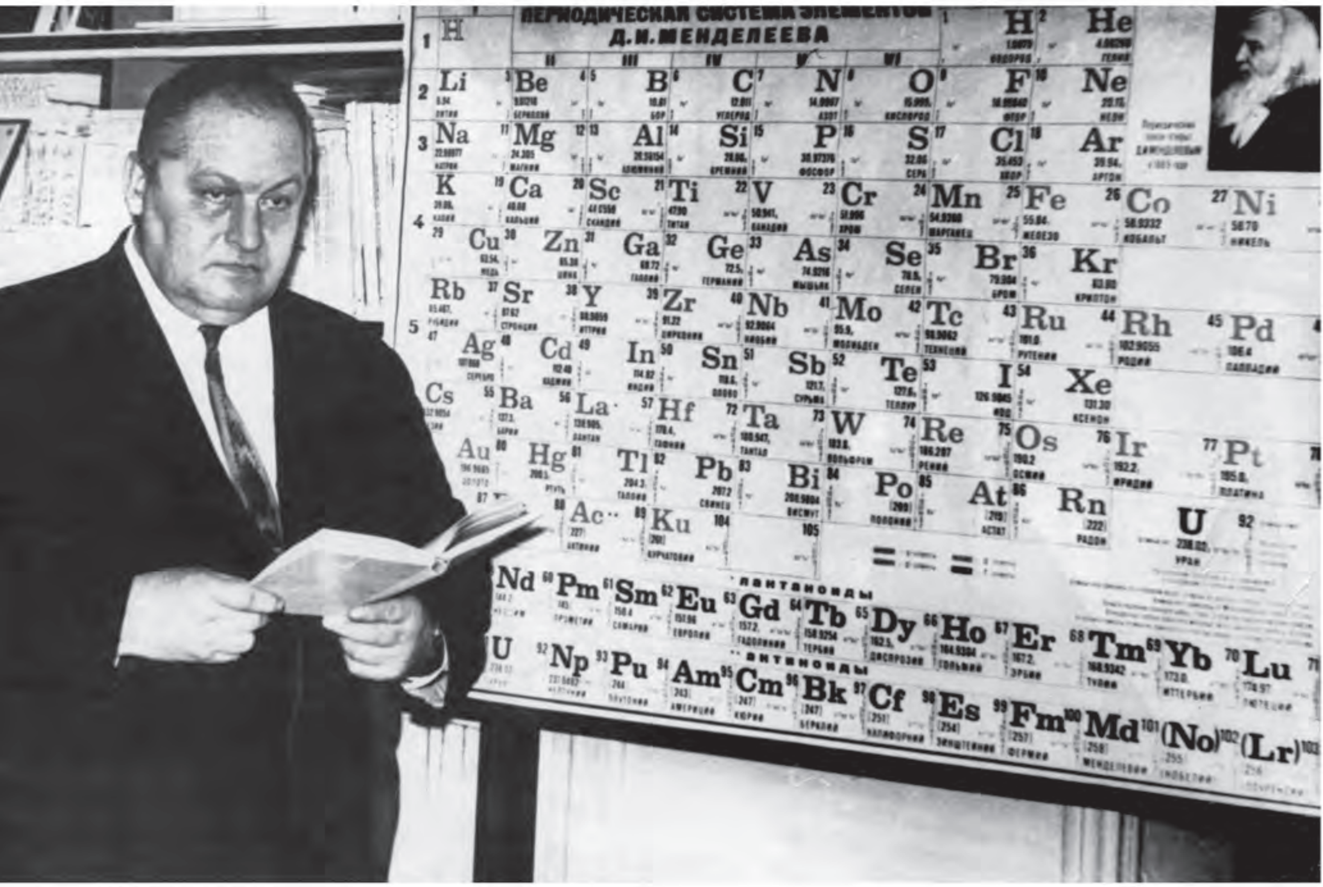
Samsonov wrote witty epigrams and fables. In his young days, he tried his hand at poetry, wrote stories, and sometimes corresponded with his close friends in verse. Generally speaking, art and literature had a very definite influence on Samsonov not only esthetically, but also psychologically and morally. He saw a connection between art and science.

To sum up, Samsonov was a scientist, Samsonov was an organizer, Samsonov was a teacher and, above all, an interesting personality. In each of these hypostases he manifested himself as a man of generous and passionate talent, huge work capacity, and titanic labor.

Samsonov died on December 22, 1975, at 2:00 PM from an unexpected miocardiac infarction. He had worked to the very end, since life without science was inconceivable to him. An unfinished article and open books lay on his hospital table...

As a scientist, Samsonov will always remain in the history of science. His researches are reflected and summed up in books, articles, and patents. They are materialized in engineering products. Samsonov's name can be found in any course of powder metallurgy, in many monographs, articles of domestic and foreign authors.

The image of Grigorii Valentinovich Samsonov as a handsome man, public figure, great scientist and teacher will remain for us as an example of selfless service to science and passionate struggle for advanced ideas.


ПЕРИОДИЧЕСКАЯ СИСТЕМА ЭЛЕМЕНТОВ
Д.И.МЕНДЕЛЕЕВА

SCIENTIST

WE CAN DEFINITELY SAY: THERE IS ALMOST NO AREA IN POWDER METALLURGY AND MATERIALS SCIENCE WHERE HIS PARTICIPATION, DIRECT OR INDIRECT, COULD NOT BE VISIBLE, WHERE HIS IDEAS DID NOT AFFECT ITS DEVELOPMENT.

S.Ya. PLOTKIN,
expert in history of science

THE ORIGINS OF ELECTRONIC MATERIALS SCIENCE

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In the stage of changing paradigms. Considering G.V. Samsonov’s scientific heritage, it is impossible to ignore his strong influence on the formation of the theoretical foundations for materials science, which primarily consisted in the development of a quasi-chemical approach to analyzing and forecasting the properties of materials, namely his configuration model of matter (CMM). Grigorii Valentinovich regarded the model as his "chief child", that is, the most significant result of all his researches.

All his technological work was filled with the ideas of CMM. They can be seen even in the personal ex-libris of the scientist. These ideas were addressed not only to consumers of physical concepts of matter, but also to producers of novel materials. At his time, Samsonov's ideas were too far ahead in the development of the doctrine of substances and materials, and they still remain a kind of artifact of the electronic theory of condensed systems, part of interdisciplinary knowledge, "not confirmed and not refused," but yet widely used in technology and thus simultaneously defying theoretical canons.

The destiny brought me to G.V. Samsonov when I was 23. Our joint work on the development of CMM lasted seven years. The evolution of his ideas proceeded before my eyes and with my participation. In the 1960th, the technology developed by G.V. was eventually transformed into a science. At the contact of the new science with physics and chemistry, rapid processes of accumulation and differentiation of knowledge occured, and G.V. paid much attention to the development of scientific principles of directed synthesis of new materials and the search for a methodology for predicting their properties. Attempts to generalize the accumulated knowledge about phenomena and processes in various (physical, chemical, and thermodynamic) model systems revealed that the key problem of analysis and forecast was the lack of a reliable basis for the very doctrine of substances and materials. The knowledge suffered from obvious eclecticism and was like the attempts to "describe an elephant by blind sages feeling separately different parts of its body."

The general principles of system analysis allow us to represent the relationship between the "anatomy" of an arbitrary dynamic system and its "physiology" as relations between the components of the basic triad "composition — structure — properties" (CSP) mediated by the interaction among all system elements. The desire to comprehend the functional relationships in CSP via the parametric dependences on pressure, temperature, and external fields brought G.V. to the conclusion that it was necessary to study more general relationships, namely "technology — structure — property" (TSP), and decipher them within the universal triad of "particles — interactions — fields" (PIF).

The scientific results obtained in this direction were summarized by G.V. in the form of his own ideas about the structure of substances and materials, later called the configuration model of matter.

Replacing the CSP triad with the TSP relations widened the opportunity to understand the nature of various forms of matter and the methods for organization of matter, such as soft and mesoscopic matter, systems with incomplete equilibrium (metastable), inhomogeneous or locally ordered, weakly stable, composed of atoms with anomalous valency or tendency to form anomalous interatomic bonds.

Appealing to the primitive concepts on elementary particles and fundamental interactions, the PIF triad opened new ways to construction of a reliable theoretical foundation for the theory of substances and materials. The transition from the concept of an "indivisible" atom, whose internal properties is only valence as a predisposition to the formation of chemical bonds, to the concept of an atom that has its own composition and structure, markedly enriched the list of atom properties. There arose the property of transferring high-energy electrons to a collectivized state while forming a polyatomic system. The current ideas about the nature of the metallic bond, the scientific principles of metallochemistry, and the practice of predicting the kinetic properties of simple metals are based namely on this property of atoms.

"Message" for the electronic theory. The transition to the subatomic level in the description of matter opened the way to studying more complex scenarios of matter formation, in particular of systems with a partial destruction of atom valence shells, or those lost energy stability, or degenerate systems, where states of localized and collectivized electrons coexist in a narrow energy interval.

In the class of oxygen compounds, many chemical elements exhibit not only a higher valence, but also other valence states (e. g., VO, V_2O_3, VO_2, and V_2O_5). In the family of carbon phases, along with a strong tendency toward the $s^2p^2 \rightarrow sp^3$ rearrangement (promoting the formation of diamond-like structures), the $s^2p^2 \rightarrow$ $\rightarrow sp^2 + c$ rearrangements also arise, with the liberation of one valence electron from the valence bond and its transition to a collectivized (c) state, which results in forming graphite-like (grid) structures. In metal-like carbides, the coexistence of Me — Me and Me — C bonds provides the observed non-ordinary combination of conductivity and brittleness. G.V. related to polyvalence of atoms and multivariance of interatomic interactions not only heterodesmism of substances, but also their polymorphism.

In the mid-1960th, in the course of analyzing the regularities of phase and structure formation, G.V. revealed the existence of a new factor which radically influenced (along with other known physicochemical factors) the basic relations, such as part — entirety, equilibrium — stability, bonding — structure, and symmetry — ordering, and was responsible for the abnormal character of the concentration, pressure, temperature, and field behavior of substances and materials — the factor of valence instability of chemical elements. The tendency to instable valence is a special property of isolated atoms that have two or more partly filled valence shells with close energy values and a strong dependence between the nature of the relative arrangement of electronic levels and the degree of their occupation by electrons. The predisposition of chemical elements to instable valence increases with increasing the principal quantum number of the valence shell. For transition and rare-earth elements this is rather norm than exception.

Comprehension of his own material science experience and generalization of the then knowledge in the field of chemistry, physics, and technology of various classes of substances and materials enabled G.V. to state that the observed atom anomalies remain when atoms are combined into a condensate, and the predisposition to valence instability generates a high sensitivity of the relations in the CSP triad to external effects. Since the observed peculiarities could not be interpreted from the standpoint of conventional atomic-chemical concepts of matter, G.V. suggested his own interpretation (expressed initially in the form of "concepts of the role of stable electronic configurations in the formation of physical and chemical properties of elements and compounds," followed by the CMM), which he widely used as a key for interpreting specific features of material behavior in various technological processes.

Interest G.V. in the problem of phase and structure formation in materials of different nature containing internally unstable atoms was vivid up to the end of his life. G.V. widely used the revealed empirical correlations which helped comprehend relations in the TSP triad and predict the features of behavior of new materials depending on the production conditions. In the found regularities, he saw something more significant than the ordinary correlations as well as in the ability of elements to easily rearranging their configuration (while interacting with other elements), he saw a new physicochemical factor of phase and structure formation, no less important for systems with valence instability than the classical size effect or electrochemical factors. G.V. considered the developed principles of controlling the valence factor not only as a new efficient tool for future technology, but also as an important "message" delivered from the area of technology to the area of the fundamental theory of matter.

Sometimes one speaks of Samsonov's jealous attitude toward his CMM and a critical one toward other approaches in materials science. It seems to me that he rather actively supported his ideas than denied others'. Characterizing the process of approving new concepts, G.V. often used R. Feynman's words, "A game of this kind, that is, a rough guessing of the relations that determine a certain community, is

typical for the first fights with nature, which preceded the discovery of some indeed profound and important laws."

I got to know Samsonov's electronic theory ideas in 1965, being a university student, from my elder brother I.F. Priadko, who was a G.V.'s graduate. At the university I had already learned "the physical doctrine of matter", a view on a science of materials as on a purely applied field of knowledge, the final stage of studying the known methodological P. Kapitza's triad "experiment-theory-practice". Following Paul Dirac, I supposed that "the basic laws necessary for constructing a greater part of physics and entire chemistry are fully known, and the only difficulty consists in the fact that the application of these laws leads to equations that are too complicated to be solved". Samsonov used the chemical "doctrine of matter" formulated by W. Pearson, "The structure is the result of complex interaction of atoms, and its formation is the first and the most important experiment in physics of solids". Although the spirit of the doctrine of materials required the unification of both doctrines rather than opposition of them, the specific and poorly studied principle of complementarity of local and collective description did not allow the "absorption" of one approach by the other and, at the same time, made it far difficult to develop a universal approach to consideration, on equal terms, zonal and atomic effects.

I managed to gain a deeper insight into the essence of Samsonov's argument a few years later when I was enrolled in the IPMS graduate school and read several hundreds of his works dedicated to solving various problems of physics, chemistry, and technology using CMM. In our joint monograph "A configurational model of matter" and in a series of subsequent articles, there was a range of issues that are most naturally viewed with attraction of ideas about the existence of configuration states in condensated systems and maximum stability of unfilled, half-filled and full-filled electronic configurations. Samsonov tried to overcome the imperfection of the then theoretical basis of the theory of materials using his configuration model, but ultimately rested on the difficulty of describing the stability of a system formed from unstable particles, that is, it was therefore necessary to construct a more consistent and correlated quantum statistical theory of matter. The basic concepts of the theory of matter, such as the concept of the Gibbs thermodynamic phases, the quasiparticle Landau concept, or the concept of Brillouin's energy bands, are only applicable to substances with stable chemical, geometric, electronic, and magnetic ordering and are intended to describe only typical scenarios of regular behavior of matter.

Processes of self-organization in systems of interacting elements, conditioned by their inclination to minimize free energy, are clearly interpreted within the framework of the Gibbs phase theory and the laws of thermodynamics only for those systems where chemical elements exhibit a stable valence and tendency to form simple chemical bonds. The aspiration to the formation of a nondegenerate and low temperature ordered ground state, postulated by the third law of thermodynamics, and the tendency toward disruption of ordering at high temperatures, postulated by the second thermodynamics law, are sufficient enough to justify the traditional ways of classifying substances (elements and compounds in aggregate states of gas, liquid, or crystal) and to understand the most general laws of the state diagram construction (existence of regions of solid solutions and mixed phases). However, interpretation of those features of substance behavior that are associated not only with structure formation, but also with the predisposition to structure change under external effects (temperature, pressure, fields) must take into account the composed nature of atoms, the presence of the internal structure of their valence shells and the ability of the latter to disintegrate due to atom-atom interaction.

Landau's phenomenological concept of quasiparticle gas also describes "normal" behavior of uniform and stable substances which do not tend toward cardinal changes in chemical, geometric, or electron arrangement.

Even at absent atomic rearrangement, the quasiparticle interaction leads to ordering of excitations, a change in the relative location of the energy levels of different symmetries, inversion of the ground and excited states, and to other disturbances of the most general classification properties of the system. Classical examples of this type are the anomalous (magnetic, superconducting) ground states of quantum Fermi liquids at low temperatures in metallic systems or anomalous excitations (exciton, polaron) in semiconductors and dielectrics at high temperatures. The studied by N. Mott and F. Anderson dielectric — metal phase transitions which are accompanied by transformation of localized electronic states into collectivized ones, irregular behavior, and the nonlinear response to external effects can serve as fresher examples.

To build a reliable foundation for the doctrine of substances and materials, great and well-founded hopes are placed on the first-principle theory of electron-atomic systems. The progress achieved in understanding the nature of the chemical bonding (in describing the electronic structure of simple molecules such as H_2 or NaCl) and a simple and clear justification for the existence of complex dielectric, semiconductor, and metallic substances within the framework of the band model allow us to hope that more complicated scenarios of the CSP relationship may be easily "deciphered" within the framework of the first principle triad PIF. Since the first-principle approach appeals to the mathematical formulation of a problem, the problems of structural materials science are considered as part of one problem of minimizing the total energy of an electron-nuclear system. Progress in solving such problems is associated with the improvement of computational procedures and the development of new mathematical physics methods. Unfortunately, only the initial "one-electron" project of the first-principle approach based on the replacement of interactions in the PIF triad by some efficient (ideally self-consistent) external fields has been realized.

Even if the character of chemical or geometric ordering is preserved in the electron-atomic system, concepts of the Bohr shells, molecular orbitals, and Bloch waves reflect only electron-ion bonds, both strong and weak, rather than electron-electron bonds. Thus, the LCAO (linear combination of atomic orbitals) states in the band theory, even though they are endowed with atomic and translational quantum numbers, do not yet have a complete set of attributes characterizing the true quasiparticles of the localized type. In the case of an arbitrarily strong degree of spatial compression of the charge density near the atom sites, the localized electrons, by the LCAO method, have the following properties: i) they always remain Bloch's type, that is, are delocalized in the energy sense (hence cannot initiate Mott's or Anderson's electron transitions); ii) they are filled according to the "anti-Hund" scheme of spin bonding (formation of localized magnetic moments is excluded), and iii) they obey the statistical Fermi-Dirac distribution (electron rearrengement due to a sharp change in the function of statistical distribution with increasing temperature, external pressure, alloying, etc. is forbidden).

An important role of the configuration interaction in understanding the transformation of localized valence bonds into delocalized molecular orbitals was shown by J. Slater in describing the evolution of chemical bonding in molecules. He also stressed the fundamental role of electron-electron interactions in the formation of the equilibrium state of rare-earth metals, "The energy bands generated by *f*-electrons are very narrow, while the interaction of 4*f*-electrons belonging to the same ion is essential and leads to the formation of a set of multiplets for each ion. The energy levels of the multiplets are located in a wider interval compared with the energy band width. It seems obvious that in this case, the calculation should proceed from consideration of the energy levels of an individual ion, after which the interaction of ions should be taken into account as a small perturbation. This procedure is radically different from one used for constructing energy bands yet at the first stage of calculation."

Violation of the normal one-electron behavior of a substance occurs in the cases of instability of a condensed system provoked by the instability of the valence structure of the initial atoms. Slater's idea of preserving the "genetic code" of electron-electron interactions in the transition from an isolated to a condensed state (since such interactions cannot be suddenly equal to zero) was formalized by W. Harrison into a more definite statement, "Only if the parameters calculated for free atoms, may be regarded as one-electron energies corresponding to the energies calculated for the solid body built of these atoms, they may be considered as one-electron energies. In other words, the Kupmens theorem is valid for a crystal only when it is valid for the free atoms that form this crystal. "In materials containing elements with unstable valence, where the excitation of one electron drastically changes the state of the other electrons, the formation of an excited state should not be regarded as a result of electron transition between stationary atomic and one-particle band levels, that is, the intention to preserve one-electron terminology in describing the influence of various external effects on matter is manifested as a deviation from the laws of normal behavior. For example, in such a case, one-electron self-consistent potential and states of individual electrons become temperature-dependent.

In transition metals, the strong interaction of intracenter and translational degrees of freedom generates new types of ordering. With approaching the unstable valence conditions, "soft" phonon modes arise, "hard" electronic bands are destroyed, and intermediate phases are formed. An increase in the accuracy of the Bloch function is unlikely to lead to a deeper understanding of the factors for phase and structure formation. For example, the current computational schemes provide calculation of the electronic state energy in transition metals within one millirydberg, whereas the accuracy of determination of relative location of the *s* and *d* bands is about half electron-volt.

The achieved understanding of the influence of chemical elements with unstable valence on the valence-atom relations in materials has promoted the development of a quantum-field approach to the description of matter and its transformation. The opportunity to consider particles and fields on an equal footing, to vary the basis, and to sort the interactions makes it possible to model the very techniques for mathematical decoupling of the variables in the Schrödinger equation, thanks to which a many-electron equation transforms into its coarse one-electron prototypes, namely Hartree-Fock-Sleter's or Konn-Shem's equations. The greatest attention is paid to the correlation-exchange component of the electron-electron interaction, which is described in the one-electron theory by a too rough local approximation, borrowed from the theory of free electron gas and poorly taking into account the changes in the interaction of two particles placed in the field of a third particle.

The behavior of weakly stable electron-ion systems is strongly influenced by the energy of Hund's exchange interaction, which even in isolated atoms is small in comparison with the energy of electron-to-ion attraction and the energy of direct Coulomb's electron-electron repulsion. Only in elements with unstable valence, where the last two contributions to the total energy are balanced, the interatomic exchange becomes a major factor which forms the sensitivity of the relative location of various valence subshells to filling them with electrons and to electron excitations, and also forms the effects of increased energy stability of half-filled and full-filled electron configurations. In the transition from isolated atoms to condensed systems, Hund's exchange energy competes with other components of the total energy such as the kinetic energy of the band motion of electrons, the energy of the Coulomb's electron-electron repulsion, and with the contribution from interactions (Coulomb, exchange, hybridization) between localized and collectivized electrons.

The attempts to combine the CMM with the ideas of the strong correlation theory and the theory of irreversible processes make it possible to represent the anomalies of the functional CSP relations as a partial version of the PIF relations realized in the case of the presence of atoms with unstable valence in condensed systems.

The original Samsonov's formulation of the CMM reflected only the limit manifestations of rearrangements in materials characterized by the formation of stable electron configurations, whereas the modern multi-electron theory binds with such rearrangements the existence of heavy-fermion, Kondo, and other complex systems, the understanding of which is important for the further development of electronics and spintronics. A number of works on borides, oxides, sulfides, and other classes of "samsonides" have shown the possibility of modeling anomalous behavior of substances predisposed to the formation of states with an intermediate valence or with atom charge ordering. A consistent account of interaction between collectivized and localized electron excitations in the region of atom valence instability enables one to trace the entire chain of the relations that determine electrokinetic properties in the space of external parameters.

"Everything is ours rather than mine." Being ahead of his time, Samsonov became for his students not only the memory of the past, but also a hope for the future. The principles of the proposed by him CMM are addressed to producers (of materials, concepts, and theories) rather than to consumers. By his words, these principles are, from the theoretical point of view, temporary constructions and should be replaced with more accurate ones through elaborating the theory of solid and liquid media. Nowadays the ideas about stable configurations, electron localization, and configuration interaction are gradually absorbed by the theory of many-electron systems, which provides a more adequate conceptual apparatus and mathematical formalism.

Samsonov presented his model in 1965. As for our joint monograph "Electron Localization in a Solid Body," it was published in 1976, after Samsonov's death. In 1977, N. Mott, J. Van Vleck, and F. Anderson were awarded the Nobel Prize "for fundamental theoretical investigations of the electronic structure of magnetic and disordered systems". At the award ceremony, F. Anderson noted, "The three of us standing here before you are united by the fact that we were inspired namely by the phenomenon of localization, that is, rather failure than success of the band theory. Our theories have much in common. First of all, having grown up in an atmosphere of universal domination of the band theory of solids, they emphasized another aspect, namely electron localization." Undoubtedly, if the fate map had been arranged in a different way, Samsonov could rightfully take his place on the list of Nobelites.

Samsonov's scientific heritage in the field of electronic materials science is in line with the legacy of the most prominent scientists of a global scale. To properly dispose it is a chance for IPMS to retain its place in the development of the theory of materials.

Samsonov was fearless and courageous in his scientific undertakings. In international scientific circles he was known as "the Russian tank of science" or "the Russian Hume-Rothery". His foreign colleagues considered his ideas to be prophetic. For those preparing for scientific degrees, he was like a ship that, once you boarded it, sailed in the right direction even if you fell asleep for short periods of the voyage. Many "samsonides" and "samsonovtsies" are connected with his name, which itself is the embodiment of the Ukrainian science of materials.

THE FOUNDER OF NEW PARADIGM IN MATERIALS SCIENCE

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My first meeting with G.V. Samsonov drastically changed my life, although at that time I did not fully realize this. Over the years, especially after his death, I got convinced more and more that it was for the first time that destiny granted me, a "blind" man, a "sighted" guide in this cruel world.

Just after admission to Samsonov's graduate school, my painstaking work began without days off and holidays and so lasted three years. With Samsonov's help I squeezed out of himself a "slave" who came from the village of Otradnoye in the Russian Far East. After the defense of my candidate dissertation, I wanted to return to Russia, but Samsonov said, "First you will defend a doctoral, then you will leave for the Far East." I took up his advice. Shortly thereafter I was invited to work at the Science Department of Kyiv Communist Party Committee. Upon learning this, Samsonov, contrary to my expectation, reacted violently, "I won't respect you any more! No committees, only science!"

Samsonov's scientific interest extended from the history of individual areas of science through the study and development of novel refractory compounds, powder metallurgy technologies up to the electronic structure of compounds and the action of concentrated energy flows and high pressures on matter. It yielded the generalization of data on the properties of elements and refractories and classification of metals and compounds.

In my opinion, the researchers of G.V. Samsonov's scientific creativity have not paid enough attention to his statement of conceptual foundations for materials science required for its further evolution.

After the death of G.V. Samsonov, materials science has covered a long way and today is in the stage of revolutionary transformation. Many new theories, hypotheses, experimental data, research methods, and, as a result, unique materials have appeared. However, herein many problems and questions have been accumulated which do not allow us to say with certainty, if there is a single fundamental science of materials or not. Obviously, there are some sciences regarding materials from various viewpoints, but a unified and generalized science about materials is still absent.

By analyzing literature data, one can draw a conclusion that current materials science is such a generalizing fundamental science. But speaking of materials science as a fundamental science, we must first name its conceptual fundamentals, that is, a conceptual framework, the basic paradigm of its evolution. The available publications do not contain information on this issue. Moreover, a number of scientists assert that materials science is mere an applied science. In particular, Academician P.A. Rebinder claimed that materials science is not a science at all, rather something like merchandizing. At the same time, one can notice the growing trend to the differentiation of material sciences, while integration processes are practically absent.

In this situation, it is impossible to analyze Samsonov's work without considering the evolution of materials science from its origins to our days in terms of the evolution of its conceptual framework. At the present, there is a need for a new look at Samsonov's work from the height of more than forty years passed since the time he left us. In this regard, I'll try to very briefly highlight the work of G.V. Samsonov in the context of the evolution of material sciences.

At the beginning of the twentieth century, a problem arose concerning not only investigation into materials and improvement of their properties, but also the creation of fundamentally new materials. The Tananayev paradigm could no longer be a basis of the fundamentally new direction in the science of materials. Consequently, the new Samsonov's paradigm "composition-structure-technology-properties" appeared, which became a pivotal step in the evolution of a new science for materials, materiology, as we named it. The new paradigm unite all the sciences (or their sections) concerning materials, such as chemistry, physics, mineralogy, crystallography, technology for processing materials, et al., into one science, capable to integrate theory and practice of creation of materials with required properties.

In the last years of his short life Samsonov realized that the creation of promising materials and prediction of their properties needed a strong theoretical footing. He came to the conclusion that the category "structure" gradually becomes a central category in materials science, and the concepts "property" and "technology" are related to it. The prediction of properties should rise to a qualitatively new level, that is, the developed simplest principles of association and correlation should give way to direct calculation of physicochemical characteristics. In this trend, a significant role belongs to Samsonov's disciple Dr. L.F. Priadko.

One of the basic features of the structure is its multilevelness, which allows us to speak about "the structure of a structure". The electronic structure is the final position in the hierarchical sequence of substructures. At current level of knowledge, it cannot be reduced to structures of other types and must be derived from the first principles of quantum mechanics, the most fundamental laws that describe the motion of matter. The electronic structure is that common basis by which all other types of structures can be expressed. Thus, the task of predicting properties, that is, of creating advanced materials, is reduced to the task of describing the principal features of the electronic structure.

However, at Samsonov's time there was no common opinion among physicists, chemists, and material scientists. Physics tended toward the construction of a solid body proceeding from electrons and nuclei, chemistry – from molecules, materials science – from atoms. As a result, there happened a situation similar to "describing an elephant by three blind men feeling separately different parts of its body."

Obviously, starting from a certain stage, the direction of the further development of the theory should increasingly be determined by the interaction of the above three approaches.

Not dwelling on details of the electronic structure study, I dare say that Samsonov tried to combine these models and to give material scientists some preliminary information on the areas of the most fruitful search for materials with required properties and further refining the structure of particularly interesting systems by step-by-step moving to needed calculations using a higher approximation. And this movement should be toward the atomic model.

Subsequently, many realized that the formation of a new science of materials should be based on the study of the electronic structure taking into account the conclusions of both solid state physics and solid state chemistry.

Materiology is a generalizing science which includes theoretical concepts for materials, mineralogy, metallurgy, crystallography, technology of materials, and materials science for various types of materials (organic, superhard, powdered, colloid, fractal, building, low temperature, nanomaterials, et al.).

Materials science is the most important section of materialogy. Mineralogy and crystallography as well as technology of materials (which is, in fact, a science of the transformation of matter into material) are also related to materialogy as its basic components. Materialogy as one of the most fundamental disciplines should be based on specific conceptual theoretical base and methodology. Herein scientific toolmaking plays one of the important roles. Therefore the general structure of materialogy should reflect the achievements of other sciences.

Samsonov took up very hard tasks in this area, feeling promising scientific directions. Together with Dr. I.F. Priadko and Dr. L.F Priadko, he wrote the monograph "Electron Localization in a Solid Body," which gave rise to mixed replies, from enthusiastic to skeptical. This work has had a great impact on material scientists and technologists. Even in the Russian Far East this theory was successfully used in studying the properties of cutting tools.

In my opinion, Samsonov overtook his era in the sense of an intuitive perception of the theory for the electronic structure of condensed systems. Because of his premature departure from life, he did not have time to express his ideas in clear physics terms, though new methods for solving the Schrödinger equation, consistent with his ideas, were then being developed, simultaneously and independently, by other scientists.

Also, significant progress had been achieved in the field of quantum statistical physics thanks to the work of both domestic and foreign researchers who created a mathematical apparatus for the adequate expression of his ideas.

It should be noted that Samsonov did not absolutize his views. He stated that they are only "temporary constructions" and should be corrected with further developing physics and chemistry of solids. I was surprised at his courage to oppose the one-electron-band theory that dominated at that time.

Samsonov, in fact, became the founder of a new generalized science of materials, whose goal was to develop principles for designing and producing materials with predicted specified properties. He determined the foundation of this science in the form of the concept "composition-structure-technology-properties."

Along with the generally recognized division of the history of mankind into the stone, bronze, and iron ages, we suggest a version of dividing the history of the evolution of materials science in a series of the following periods:

- Antique (VI-IV c. B.C.; Democrytus, Platon, Aristotle);
- Alchemical (XII-XVIII c.; Plinii the Sinior, Albert the Great, Basil Valentine, Paracelsus);
- Atomic-Molecular (XVIII — today; Lomonosov, Dalton, Avogadro, Rutherford);
- Elemental (XIII-XX; Mendeleyev);
- Material-Scientific (1930-2000; Tananayev);
- Materiological (2000 — today; Samsonov);

Since 2000, Samsonov's paradigm has been a conceptional base for the materiological period.

SEARCH FOR THE ESSENCE OF SINTERING PROCESS

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Grigorii Valentinovich Samsonov was a man inspired by the desire for knowledge of the world. If the occupation of science is the search for truth, then G.V. Samsonov devoted his life to its disclosure. And he became a model of the scientist. The great Serbian writer Ivo Andrich said about such kind of people, "A sage is one who does not view phenomena of the world in their isolation, but constantly unites all things happening in the world."

G.V. Samsonov always sought connections between phenomena. He had an inherent capacity for unexpected and paradoxical conclusions. As known, the first theory of sintering, proposed by Ya.I. Frenkel, highlighted transport processes in the solid phase and inspired new researches in the science of sintering. Inspiration is a driving force, opening up new horizons in the understanding of the world. This is inherent for both poetry and science. "Real science and real poetry do not only come to touch, but they also have deeper common features," wrote M. Petrovich-Alas, a Serbian mathematician. These words correspond to the well-known statement of A. Einstein, "In scientific thinking there is always an element of poetry. True poetry and true science require the same process of thinking." It is in this light that one should understand the idea of Samsonov's configuration model of solids as a footing for the structural hierarchy, with which he ensured the integrity of materials science, relying on the triad "technology-structure-properties."

Being at the top of the original way of discovering new laws of materials science, G.V. Samsonov considered the fundamental problems of sintering process at the deepest microlevel of the structural hierarchy, namely the electronic level. He began the presentation of his concepts as follows, *"At the present, fundamental ideas are being developed on the mechanism and kinetics of sintering, which enables one to make a significant contribution to the theory and technology of sintering and to the development of many technological processes in order to fabricate various products from ceramics and cermets. However, despite the significant progress, the process of analysis as a whole and its individual aspects and stages are* *considered on the basis of various theoretical predecessors, usually at the atomic level, i. e., the level of atomic mass and energy exchange. This does not allow us to create a single sintering theory based on general representations, not to mention the fact that current sintering theories either do not take into account at all, or insufficiently take into account the chemical nature of substances to be sintered.*

Therefore, in recent years, the development of ideas on sintering based on the subatomic, i.e. electronic, structure of matter has begun with using various models of the electronic structure of matter, including the model of the density of states and the configuration model of matter. The most convenient model is the configuration model, which provides a clear enough qualitative, sometimes semi-quantitative, representation of the mechanisms of processes running during sintering."

After discussion on the foundations for the configuration model, G.V. Samsonov wrote:

"The use of this model makes it possible, first of all, to present the structure of oxides and to interpret their properties. The oxide formation is reduced to the fact that the outer valence electrons of metal are transferred to oxygen atoms, whose electronic configuration tends to the most stable configuration of inert gas (sp), with formation of the ionic bond between atoms of the oxygen-forming element and oxygen. However, the ionic bond, firstly, is not the only form of bonding in oxides and, secondly, in a number of cases it is not prevailing, yielding to the covalent and metallic bonds. In addition, it should be taken into account that the valence electrons of metal or nonmetal are only statistically located on the outer shell of oxygen atom in oxides during some average statistical time of dwelling on this shell.

Obviously, the ionic bond Me–O is most completely realized when the number of valence electrons transferred to the oxygen atom is two. However, in these cases, in addition to the ionic bond, metallic and covalent components can be formed. For example, we can consider the oxides formed by beryllium, magnesium, and alkaline-earth metals (Ca, Sr, Ba, and Ra), which are the basis of many ceramic materials. All these metals have two external valence electrons (s), but the behavior of these electrons and, accordingly, of the metals to which they belong, is significantly different. The principle quantum number of s-electrons of beryllium atoms is the smallest, and therefore they tend to transform into the sp configuration through the one-electron s-p transition. This configuration is the strongest for 2s2p electrons. The formation of the sp configuration, which tends to completion to more energetically stable states through the capture of the partner (oxygen atom) electrons reduces the dwelling time of valence electrons of beryllium atoms on the outer shells of oxygen atoms. Thus the ionic bond is supplemented by a certain fraction of the covalent bond (sp) and the metallic bond. Statistical transitions of electrons between beryllium and oxygen atoms cause the electron-electron interaction, which, as mentioned above, leads to weakening the interaction between atoms and, as a result, to reducing the related physicochemical properties. In going to magnesium, the probability of the s-p transition decreases due to the increase in the principal quantum number of the valence s-electrons, and so the lifetime of the sp configurations of oxygen atoms and the fraction of the ionic Me-O bond increase. The decrease in the electron-electron interaction causes *strengthening of the magnesium oxide lattice in comparison with beryllium oxide. Therefore, the melting point increases from 2530 °C for BeO to 2800 °C for MgO. With further passage to calcium oxide, the probability of the s-p transition decreases even more, but the vacant third level of calcium atom appears, to which a partial transition of the valence electrons of calcium is possible. This leads to a decrease in the probability of transfer of calcium valence electrons to oxygen atoms, a decrease in the fraction of the ionic bond (i. e. an increase in the fraction of the metal bond) and, accordingly, a decrease in the lattice strength, and melting point (CaO melts at 2570 °C). A further passage to strontium and barium is associated with an increase in the transition of the valence s-electrons to the d-states of metallic atoms, since these states are enhanced energetically with increasing principal quantum number of d-electrons (weakening the Me–O ionic bond and decreasing the melting point (SrO 2430 °C, BaO 1923 °C)). Thus, the "anomalous" behavior of MgO, as compared with the other metal oxides of the IIA subgroup of the periodical table, is, in fact, quite logical.*

Basing on the above described tendency, one may conclude that further increase in the melting point of MgO is possible when it is added with elements that suppress the ability of the valence electrons of magnesium atoms to the s-p transition. An increase in the melting temperature of calcium, strontium, and barium oxides is possible via adding elements that suppress the probability of s-d transition, for example, active donors capable of filling the states of these metals.

It is particularly important that G.V. Samsonov considered pressing not as an independent process, but as a specific stage of sintering. Subsequent works on cold sintering confirmed the correctness of this approach.

"*As known, in manufacturing oxide ceramics, the first stage of product formation is pressing followed by a sintering operation. It seems that the separation of these operations, logical from the technological viewpoint, is theoretically untenable, since the sintering mechanisms begin as early as in the course of pressing, developing and intensifying further sintering. This does not exclude the appearance of new mechanisms, specific for sintering only.*

Under sintering the electron exchange intensifies, which causes the processes of surface and bulk diffusion, viscous and plastic-viscous migration, recrystallization, evaporation, and condensation. All these phenomena and stages of sintering can be described on the basis of electronic representations; however, the relevant work only just began and is still limited to a qualitative description, which, nevertheless, is unified and high-productive. The parameters of diffusion processes during sintering are uniquely determined by the degree of localization and its variation."

Basing on his theoretical ideas, G.V. Samsonov gave the following explanation of the activated sintering: *"To activate sintering of oxides with a dominant covalent or ionic bond, it is obviously necessary to make additions of metal oxides which contribute to the ionic bond as well as weakly bound electrons with a small average statistical lifetime at the core of the atoms. For example, such accelerating sintering may be provoked and activated by addition of lithium oxide to magnesium oxide or germanium oxide to magnesium oxide. This increases the total fraction of the ionic component and causes a* *decrease in the relative sintering temperature of oxides with a smaller fraction of the ionic bond. However, the amount of these additives should be very limited, since they can form chemical compounds or solid solutions with the basic oxide, which leads to the formation of inert barriers that prevent further sintering, and also often causes "loosening" during sintering due to crystallographic reorientation, to which the formation of chemical compounds is related.*

An important role in the activation process is played by accelerating diffusion owing to decreasing electronic exchange between diffusion ions to create the most energetically stable electron configurations in them.

The activating effect on sintering process is also exerted by stoichiometric defects. In this case, due to the lack of metal or oxygen ions, the localization of electrons of oxygen or metal atoms increases, which leads to an increase in the mobility of ions with a higher degree of localization (for example, the activating action of excess oxygen ions in the lattice of uranium dioxide). "

And in conclusion G.V. Samsonov wrote, *"Thus, the electronic structure of oxides and its change under sintering is the most common basis, on which almost all stages and effects as well as all the mechanisms of sintering can be considered from a unified point of view. The development of these concepts will significantly limit the areas of experimental searches, will help reach the required results more purposefully and rapidly, will make a significant impact on the improvement of sintering technology, and, ultimately, will allow the creation of ceramic compositions with predetermined properties".*

The search for G.V. Samsonov's essence of sintering process is unfinished work, which may add one more chapter to the book of Nature. His scientific heritage is a key to understanding the very logic of processes, without which further development of material technology is inconceivable.

THE CREATIVE ROAD OF G.V. SAMSONOV

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The work of G.V. Samsonov was always first-class and ranked among the very peaks of the world science. His creative thinking and overall scientific activity were permanently directed toward discovery, development, research, and application of refractory compounds with special properties. He was one of the first people in the USSR to undertake extensive research on methods for obtaining a wide range of refractory compounds, such as borides, carbides, nitrides, hydrides, silicides, phosphides, aluminides, and germanides of transition and non-transition (alkali and rare) metals as well as actinium compounds and nitrides of boron, aluminium, and silicon. In his search for materials with special properties, he began to experiment with complex systems of multicomponent compounds, in particular carbonitrides and carbohydrides. All these studies were directed toward practice.

He performed numerous thourough experiments in the field of technology of powder metallurgy and arrived at the theoretical basis for pressing and extrusion, casting, and reaction sintering. His research gave industry heat-resistant thermocouples, protective coatings for metallic thermocouples, products made from hard alloys, heaters for electroresistant furnaces, resistors, cathodes, and the like.

The technologies developed under Samsonov's leadership represent today the groundwork for a series of plants for production of refractory compounds.

Alongside with the development of methods for obtaining refractory compounds, Samsonov undertook a systematic study of properties of the materials mentioned above. He succeded in enlarging the number of refractory compounds and analyzed their electric conductivity, thermoelectric motive force, Hall effect, magnetic properties, dynamic characteristics of the crystal lattice, radiation coefficient, vapor pressure, nonmetal-to-metal diffusion parameters, catalytic, thermoemissive and absorption properties, microhardness, microbrittleness, friction, and wear at high and low temperatures as well as abrasive properties.

His major trait as a researcher was a desire to discover the nature of compounds. His scientific principle consisted in acknowledgement of the primary importance of the electronic structure in the formation of physical, chemical, and technological properties of materials.

Samsonov conducted a great deal of experiments on the chemical bonding and electronic structure of refractory compounds using conceptions on the probable formation of stable configurations by valence electrons, and on this ground, he suggested that the Heitler-London model be combined with the zone theory.

In spite of this extraordinary broad scale of interest and knowledge, Samsonov was never satisfied with what had been achieved and always sought to discover and implement new ideas.

He was exceptionally brilliant in leading a scientific school which he founded and whose headquarters were located in IPMS and KPI. He brought up hundreds of scientists, who are now scattered throughout the world. Over one and hundred and fifty candidates and doctors of science were once his students.

Samsonov worked to renew mankind's bonds with nature, since he knew, better than anyone, that processes of differentiation must be accompanied by processes of integration, otherwise we will only succeed in the creation of an illusion of penetration into the secrets of nature and the world, whereas, in fact, we will contribute to process of dissimilation and alienation. We must be able to look ahead and foresee the consequences of practical implementation of our discoveries, which could be pregnant with dangers. For reasons of this kind, Samsonov advocated unity in physical and chemical approaches and was oriented toward materials found in nature. He, therefore, constantly emphasized the importance of analyzing the properties, structure, and technology of materials from both the general and individual aspects of their electronic structure. Analyses of this kind were used in studying hydrides, borides, carbides, nitrides, oxides, silicides, halcogenides, aluminides, phosphides, beryllium, and magnesium compounds and other "samsonides", which served as a basis for constructing configuration models of materials. Samsonov had a magical power for understanding complex situations, which enabled him to avoid one-sided approaches to problems even when the theory of electronic structure was based on such simplified conceptions as solid state models within the theory of alloys, "metalloids", theory of refractory compounds and surface phenomena in emission and absorption.

He laid down the basic principles of the founded school of science. This school advocated that scientists always have to keep an open mind and never accept statements without deeply analyzing them. They have to search for the truth, because "science should be in the service of mankind and not *vice versa*".

Additionally, Samsonov acted as a coordinator and stabilizer and helped everyone who entered his orbit. He was always ready to give his moral support and lent confidence to the people around him. Theoreticians came to him for assistance when they had found difficulty in putting their abstract theories in practice. Conversely, those dealing with practice found it easier to understand the theoretical groundwork of their projects after consulting him. Those who lacked decisiveness gained a greater conviction. In fact, anyone having original ideas could count on his unselfish support. But he could be stern at times when he met scientific impotence. It is impossible to list all those whom he helped. In particular, for those of us who were his students, he set a high standard and example of hard work, a good-natured disposition, perseverance, and a profound sense of justice.

Samsonov was always ready to defend his conceptions once he was convinced of their validity. His work on developing the configuration model of matter is a lesson of courage in defense of principles. When the model was first conceived, he listened to all critics and consulted many experts. Before publishing his ideas in scientific journals, he prepared a preliminary paper and distributed it among scientists whose opinion he wanted to know. Soon there appeared comments in scientific journals, anonymous allusions, that is, a considerable amount of bad blood. Samsonov defended his conceptions baldly. Even after strong attacks by his adversaries, he did not lose heart.

Samsonov was a tremendously noble man, sometimes even at his own expense. Saint-Derdy used to say, "Brain is not an organ of thinking but an organ that enables us to survive like animals". Perhaps Samsonov's life was short because he never used his brain as an organ of survival.

Also, he had never any inclination to seek out people who could lend their support for him administratively. A bitter truth remains: he, who contributed so much to the progress of so many people in their scientific careers, did nothing to promote his own career and thus, did not cover an inch of his career ladder for fifteen years. The titles that were not bestowed on him are of little importance and remind Balzac's "*de*", which was procured at such a high price but could add nothing to the excellence of his "Human Comedy".

In 1975, Samsonov's creative power was at its height. His many plans and projects remain unfinished, and it will be up to his followers to realize them. His recognition will grow because "Heine has no need of monuments, but we need monuments to Heine."

GRADIENT MATERIALS AND ELECTROSPARK DISCHARGE

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The work on the use of electrophysical processing methods (electrospark alloying, laser, ultrasonic, electromechanical processing, *etc.*) began at IPMS on the initiative and under the direct leadership and participation of Grigorii Valentinovich Samsonov. Thanks to his scientific foresight, scientific fundamentals for these methods were developed, and modern technologies and advanced materials were created.

Electrospark alloying is based on the phenomena of electrical erosion and transfer of the anode material (processing electrode) to the cathode (a workpiece) in the course of electric discharge. The spark discharge occurs in microscopically small volumes and lasts 100-400 μsec. In this process, very high energy flux densities are realized without appreciable heating of the sample being processed. The process is characterized by substantial non-equilibrium, and this allows one to obtain fundamentally new materials in the surface layers of coatings, which is impossible under the ordinary equilibrium conditions. The electrospark method is used for surface hardening of metals in order to increase wear resistance through the formation of protective coatings acting against the influence of aggressive operation media. Hardware support for the work was realized thanks to close cooperation with the Institute of Applied Physics of AS of Moldova, and later with Luhansk Design Institute of Mechanical Engineering.

At first, fundamental research was carried out to study the regularities of electrode erosion during electrospark alloying. The influence of the nature and properties of the electrode material on the process of its transfer to the substrate (cathode) and formation of a hardened surface layer was studied in detail. On the basis of established regularities, scientific principles for creating electrode materials with a required level of physical and mechanical properties were developed in order to harden or restore parts of machines, devices, and tools. Below follows a brief retrospective of the results of some studies performed in this direction by students and followers of Grigorii Valentinovich Samsonov.

The main regularities of anode erosion. According to the results of investigations for electrode materials from metals and alloys, erosion occurs mainly in vapor and liquid phases and decreases with increasing melting temperature of anode material, heat of sublimation, modulus of elasticity, and lattice stiffness coefficient, that is, those material properties that characterize the strength of interatomic bonds.

Samsonov suggested using refractory compounds such as carbides, borides, and nitrides of transition metals as an anode material. The nature of their erosion turned out to be different from that of metals and alloys. In the erosion products, the number of particles in the solid state sharply increased. In addition, experiments showed that porosity significantly affects the erosion resistance of refractory compounds. On the one hand, an increase in the refractory anode porosity facilitates its destruction under the action of concentrated energy flux and reduces the anode erosion resistance. On the other hand, due to the action of heat and mechanical loads on the anode surface, the surface layer becomes more condensed, which contributes to an increase in the erosion resistance. In this case, owing to the reverse transfer of the cathode material to the anode during the contact of electrodes, a hard alloy layer is formed on the anode surface, in which the refractory compound of the anode material serves as a base, whereas the cathode material acts as a binder. The higher the initial porosity of the anode material, the more intense processes of densification and alloying. Since the erosion resistance of hard alloys is substantially higher than that of the refractory compound that is basic for the alloy, the appearance of a thin layer of hard alloy on the anode surface leads to an increase in the anode erosion resistance. The longer process of electrospark hardening, the more efficient this effect. When the rate of the anode material erosion becomes equal to or higher than that of densification and alloying in the surface layer, the erosion resistance of the material depends on its nature and initial structural state and does not depend on the time of hardening.

The erosion of refractory compounds is markedly dependent on the nature of the substrate (cathode) material and the conditions of hardening, namely on the pulse power and duration, the composition of interelectrode medium, and the time of hardening. Practically for all electrode materials, an increase in the pulse power results in monotonically increasing the anode erosion. The composition of the interelectrode medium influences erosion in the case the anode material interacts with the medium and this interaction increases the material tendency to brittle fracture under the pulse action at high pressure and temperature. In the case the anode material actively dissolves oxygen and nitrogen (for example, Ti and Zr), its erosion resistance in air can be lower than that achieved in an inert medium by an order of magnitude. In the general case, the total anode erosion increases with increasing time of hardening, but a directly proportional dependence is possible only if the composition, structure, and stress state of the anode material do not change under electrospark hardening. Such ideal conditions are never realized, because the composition of anode surface layer always changes due to the interaction with the cathode material and the surrounding medium. In the anode surface layer subjected to the action of nonlinear heat fluxes and mechanical loads (when the vibrating electrode touches the surface being processed), the composition and microstructure change and residual stresses appear, whose intensity and sign vary along the thickness of the defective layer. As a consequence, the intensity of anode erosion changes as well. Most often, it is maximal at the first stage of the process lasting 1-3 min/cm^2.

Formation of surface layer on cathode (coating). The kinetics of increasing coating thickness was studied at a constant pulse repetition frequency; herein anode erosion remains constant for a long time. The largest amount of material on the cathode is fixed within the first minutes of process, then it decreases and, at a certain moment, the destruction of the deposited layer begins. A complex of studies made it possible to elucidate the causes of this phenomenon and to develop methods for increasing the ultimate thickness of the coating.

Electrode materials. The results of the works initiated by G.V. Samsonov on the creation of electrode materials from refractory compounds showed that pure (nonalloyed) refractory compounds have a limited application. Their high hardness, brittleness, shape and size of the erosion products cause a poor fixation of them on the substrate and, as a result, a small thickness of the hardened layer (not over 15 μm) along with its high roughness. Studies have shown a promise of using refractory compounds in the composition of hard alloys with various metallic bonds. For this purpose, WC, TiC, ZrC, Mo_2C, TiB_2, (Ti, Cr) B_2, W_2B_5, TiCN, TiN, and AlN were most often used. It was established that the higher the initial brittleness of the refractory compound, the higher the binder content at which the maximum transfer of the alloy from anode to cathode is achieved. An increase in the amount of binder over an optimal value leads to high content of fusible alloy components in the erosion products, which, on getting to the zone of electrospark discharge, melt and become partially vaporized or sprayed. As a result, the amount of the anode material transferred to the substrate decreases.

When studying the dependence of the erosion properties of hard alloy electrode materials on the carbide grain size, it was found that the efficiency of hardening increases with increasing grain size from 0.5-0.8 μm to 2-3 μm and decreases with further grain size increasing to 5 μm. At a grain size of over 3 μm, an essential contribution to the overall erosion of the anode is made by brittle fracture of the alloy, which leads to a decrease in the amount of the transferred eroded material.

Furthermore, the erosion properties are markedly dependent on the residual porosity. The optimum erosion properties are observed at a porosity of 3-5%.

In order to achieve high efficiency of hardening process, it is necessary to use an electrode material with low erosion resistance, the erosion products of which are transferred to the substrate in the molten or softened state. In the case of hard alloys, this is possible when the erosion products are superfine and thus have time to warm up to high temperatures.

It follows that by controlling the structure of anode material, it is possible to substantially increase the efficiency of electrospark hardening. Implementation of the obtained knowledge in the development of carbide electrode materials allowed significantly increasing the thickness, continuity, and hardness of coatings.

Along with increasing wear resistance, protective coatings on metal surfaces can increase the heat and corrosion resistances at high temperatures. This is especially noticeable when aluminum nitride based coatings are deposited on titanium and its alloys. The composite 40AlN-60$MoSi_2$ (mass %) is optimal from the viewpoint of electrospark alloying efficiency: the microhardness of the coating is more than twice that of the titanium substrate, and high temperature exposure provides the formation of hard heat-resistant phases which form a protective layer with a hardness of up to 18 GPa and a transition zone thickness of up to 300 μm. Furthermore, it was established that when the titanium alloy is electrospark-alloyed with this composite, its heat resistance rises by a factor of 6-8.

Investigation of the kinetics of electrospark alloying of steel substrates with Ni-Cr-Al alloys revealed that the trinary eutectic 50.3Ni-40.2Cr-9.5Al (mass %) is the most efficient for restoration of worn components. Study of the heat resistance at 1000 °C of steel 45 samples with Ni-Cr-Al alloy coatings showed that their scaling resistance is 15-25 times higher than that of steel 45.

Further researches carried out by Samsonov's followers have provided significant improvement in the properties of electrospark coatings owing to using the following techniques:

Smoothening of electrospark coatings with hard alloy tools. Smoothening of coatings obtained with the T15K6 alloy containing a modifying additive is accompanied by a small decrease in tensile stresses. The maximum value of the latter is 200 MPa, whereas for unsmoothed coatings they are equal to 500-600 MPa.

Laser treatment of electrospark coatings. It was established that under laser treatment, metallurgical processes of melting in the coating and substrate materials and in their mixing occur, which leads to the formation of new phases and compounds. In this case, the quality of the hardened layer improves (thanks to the disappearance of pores and microcracks), and its depth increases by 4-5 times. The gradient of residual stresses in the alloyed layer decreases due to relaxation of tensile stresses in the molten zone. This reduces risk of cracking during coating operation. A characteristic feature of the material structure after laser exposure is a high degree of dispersity and formation of solid solutions in a wide range of concentrations, which contributes to the improvement in the physicomechanical properties of coatings.

Electrospark alloying combined with laser treatment increases hardness, heat resistance of surface layers of tool materials, improves the contact characteristics of cutting tool when interacting with chips, which ultimately increases its wear resistance.

Thus, the use of laser treatment makes it possible to intensify the formation of coatings, to improve their qualitative characteristics, to regulate the processes of obtaining coatings with a certain set of physical and mechanical properties, and to create the required microrelief on friction surfaces. In addition, there appear wide opportunities for automation and computerization of technological processes. The use of laser for coating treatment is a promising trend of current materials science.

The developed materials and technologies for their manufacture have been used to increase the durability of dies and tools, restore and prolong the life of parts of various designs. The results of the work have been implemented in more than two hundred enterprises of Ukraine and other countries in the following branches of industry: engineering (including transport and heavy industry), energetics, metallurgy, aircraft construction, light industry, woodworking, food processing, and instrument-making.

The work on the creation of scientific fundamentals, equipment, electrode materials, and technologies for electrospark alloying was highly appreciated by the society: it was awarded the State Prize of Ukraine in the field of science and technology (1994) and the Prizes of Presidents of NAS of Ukraine, Belarus, and Moldova (1999) .

About forty years have passed since Grigorii Valentinovich was gone. Over this time, many of his scientific ideas have found a real embodiment. Thanks to his wonderful scientific foresight, new electrode materials with predetermined properties have been created and widely used in practice; modern equipment and technologies for electrospark alloying have deen developed. The method of electrospark alloying has become widespread both in our country and abroad. Only at IPMS more than twenty candidate and doctoral dissertations devoted to studying the peculiarities of the process mechanisms and the development of new materials, equipment, and technologies have been defended.

All of the above is a clear evidence of the correctness and vitality of the ideas and trends which G.V. Samsonov gave rise to and which are being developed by his disciples and followers at the present. Surely, many else Samsonov's ideas will be realized in the future.

GREAT GIFT OF SCIENTIFIC FORECASTING
History of the creation of hard tungstenless alloy

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Grigorii Valentinovich Samsonov, among the variety of trends of his fruitful scientific activity, founded in Ukraine a scientific trend for improvement of sintered metal/ceramic alloys and creation of new hard tungstenless alloys.

In the 1960s in the whole world, and especially in the former USSR, there was a big shortage of raw tungsten. Its resources were predominantly used for military purposes, whereas for the production of hard alloys and tool grades of tungsten steels, its available amount was scarce.

In 1968, at the department of high temperature materials and powder metallurgy in KPI, together with the Chirchik branch of the All-Union (now All-Russia) Research Institute of Hard Alloys (VNIITS) and the Uzbekistan Combine of Refractory and Heat-Resistant Metals (UzCRHRM), under the general scientific guidance of G.V. Samsonov, systematic research on the development of new sintered tungstenless hard alloys started. Soon, in order to accelerate this work, a special group of employees was formed, headed by the former Samsonov's graduate student V.K. Vitrianiuk.

To broaden application of tungstenless hard alloys, Samsonov and the staff of the department simultaneously conducted research on the development of materials on the basis of other refractory compounds that could operate under shock load conditions, *i. e.*, on the creation of more versatile hard alloys.

On the basis of the developed by Samsonov and his school ideas concerning the nature of electronic exchange between atoms of metal and nonmetal (in particular for the Me-C and Me-N couples) leading to the formation of stable electron configurations, it was prior assumed that at a certain C / (C + N) ratio in the titanium carbonitride lattice, such a total fraction of stable electron configurations (s^2p^3) may be formed that could be close to that of tungsten carbide. Therefore the corresponding titanium carbonitride may be more ductile compared to titanium carbide or titanium carbonitrides of other compositions, and so may meet the requirements for a hard component of tungstenless alloys to a greater extent.

As a result of investigation by Samsonov's graduate G.V. Bilyk into properties of a number of transition metal carbonitrides, alloys on the basis of titanium carbonitride with a nickel-molybdenum binder 80 Ni — 20 Mo (vol %) were fabricated at the department. Their properties were comparable with those of the T15K6 alloy and even much higher.

In our opinion, the information given below is very important in terms of priority concerning the production of hard alloys based on titanium carbonitride in the world, in particular in the former USSR.

We got to know about the report by R. Kieffer (Austria) at the VIth International Powder Metallurgy Conference in the USA in July 1970, in which he suggested using titanium carbonitride as a hard component for alloys. However, in his publication in 1971, it was pointed out that, unlike titanium carbide alloys, the samples from titanium carbonitride were very poor sintered. It follows that the materials under his study were non-technological. In addition, there were no data on performance properties. Instead, the attention was paid to the color of the samples (bronze-golden, interesting for jewelry industry).

As for our parallel investigation, its results were reported at the Xth All-Union Conference on Powder Metallurgy held in Kyiv on January 19-22, 1971 with the following conclusion: "... in the future, research on improving physical, mechanical, and performance properties of alloys is the most expedient in the trends:

i) specified regulation of the structure, including the creation of reinforced alloys and ones with varying physical and mechanical properties along the cross-section;

ii) creation of tungstenless hard alloys on the basis of a wear-resistant component with increased ductility combined with dispersion strengthening of the cementing phase".

Over the subsequent 46 years, *i. e.*, up to date, the scientific forecast of G.V. Samsonov, expressed in the latter trend, has been fully confirmed.

An increase in strength properties of the further developed KTNM alloys was achieved thanks to increased ductility of titanium carbonitride compared to that of titanium carbide. It was also found that alloys based on titanium carbide and titanium carbonitride significantly exceeded the scaling resistance of the standard T15K6 and T5K10 alloys by 10-20 times. Herein a thin dense oxide film, formed on the surface of a part, exhibited high adhesion to the part material and acted as a lubricant at high temperature.

The industrial production of TN20 alloys with a nickel-molybdenum binder started in 1972 at the UzCRHRM and it was the first in the former USSR production of tungstenless alloys.

As for KTNM30 alloys on the basis of titanium carbonitride developed and manufactured at the department of powder metallurgy in KPI, they exhibited high perfomance characteristics meeting the requirements of industry. They were the first in the world tool materials on the basis of principally novel material, titanium carbonitride, which at that time seemed to the leading experts on steels to be impracticable at all.

Shortly after, our department became a scientific center in Ukraine on the development of new alloys and tools from them. It trained experts from not only the former USSR, but also from the former GDR, France, Romania, Bulgaria, and other countries. In 1972, an interesting remark was made by Finnish Professor M. Tikannen who in a letter to G.V. Samsonov underlined, "...we get even more convinced of the high level of your scientific research."

It it is worth noting that Grigorii Valentinovich considered the exchange of scientific information and the latest developments with leading scientists, both inside the country and abroad, to be very important for the development of science as a whole. He gladly informed various industrial enterprises throughout the USSR about our innovations. Moreover, once upon a request of one of the enterprises in the distant city of Perm (Russia), he sent V.K. Vitrianiuk to provide practical assistance (absolutely selflessly) in debugging the technology for manufacturing various hard alloy products.

In 1971, the Institute of Chemistry of the Ural Scientific Center of RAS began investigating titanium carbonitride and tried to obtain cermets on its basis. G.V. Samsonov provided them, as dear colleagues, with valuable information on our related works and even with practical assistance from the department without saying a preliminary word in any public speech or publication. Very soon the "dear Ural colleagues" received author's certificates on these materials (our cooperation agreement remained on paper). As a result, our priority was destroyed (to be exact, stolen).

In 1973, the pilot-industrial production of tungstenless TN20 alloys was organized at Kyiv Branch of "Orgprimtverdosplav" located in IPMS, where soon a technology for the manufacture of a harder TN50 alloy was developed to be implemented in various industrial enterprises producing wear-resistant parts and cutting tools.

As for similar developments abroad, the first alloys on the basis of titanium carbide in the world were TiC-Ni-Mo (Mo2C) alloys of the American company "Ford" (1950-60th years). In the former USSR, the first commercial alloy TH20 was developed by the KPI-VNIITS-UzCRHRM cooperation in 1965.

Tungstenless alloys based on titanium carbonitride, fit to practical application and production, KTNM30A, B, were first in the world manufactured and tested at KPI (1969-72). Since 1972-73, the development of new hard alloys in the world has been carried out using titanium carbonitride only. In plates with multilayer coatings, it has become possible to combine the high strength of the substrate (plate itself) with increased wear resistance of the coating.

As follows, alloys on the basis of the TiC + TiN system, NTN30 and NTN40 grades, created by G.V. Samsonov's former students became a logical continuation of his ideas and assumptions.

Finally, I would like to mention an episode of G.V. Samsonov's activity and his excellent human qualities. In September 1975, Grigorii Valentinovich, together with V.K. Vitrianiuk, visited Dnipro Hard Alloy Plant to get acquainted with the production of tungstenless hard alloys. In his extensive lecture G.V. Samsonov spoke about the state of world development and directions of improvement of tungsten-containing and tungstenless hard alloys, which aroused keen interest among the listeners. He was in a good mood and manifested a brilliant, inherent humor. Therefore, the communication and the trip, as a whole, proved to be very fruitful. We saw many G.V. Samsonov's ideas implemented in practice.

To our great disappointment, that was Grigorii Valentinovich's last public speech. Soon after this trip he was taken to the hospital. Being unwell, Grigorii Valentinovich worked hard on scientific articles and dissertations. In such a bad condition, he found time to keep up his permanent tradition, sending the authors of these memories warm and cordial wishes for "the hardest hard-alloy luck."

SAMSONOV'S CONTRIBUTION TO SCIENCE OF REFRACTORY CARBIDES

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G.V. Samsonov studied many types of materials, but his greatest attention was paid to refractory compounds and particularly carbides. He was fascinated by the simplicity of the crystalline structure of transition metal (Group IV-V) carbides, on the one hand, and the complexity of their electronic structure, on the other hand. His first work on refractory carbides dates back to 1952. The final bibliography of his works reveals 150 major papers on refractory carbides. His exhaustive monograph "Physical Material Science of Carbides" was issued in 1974.

Refractory carbides of transition elements are well-known for their high melting point, hardness, and other valuable physical and physicochemical properties. Numerous attempts have been made to understand the nature of carbides on the basis of their electronic structure, but the opinions have been still conflicting. The period of 1962-65, when interesting results on X-ray spectroscopy of transitional metals appeared, was of great excitement to Samsonov. The varying localization of valence electrons in different transition metals belonging to different groups and periods of the periodical table of elements gave a clue to him to propose his "configuration model of matter". According to the model, the localized fraction of valence electrons forms a broad spectrum of configurations, in which maximum statistical weight is possessed by the energetically most stable electronic configuration corresponding to minimum store of free energy. Such stable electronic configurations (according to the degree of descending energy stability) are d^5, d^{10}, and d^0. Between them and non-localized fraction of valence electrons, an exchange takes place, which is responsible for bonding. Using available X-ray data, Samsonov gave different SWASC (statistical weight of atoms with stable configurations) of the d^5 configurations to different transition metals. Although these values were not very precise, they were handy in understanding, at least qualitatively, the formation of various refractory compounds. In the case of carbides, he supposed the transfer of non-localized electrons from transition metals to carbon in order to stabilize the sp^3 configuration of carbon atoms to various levels. The donor capacity of transition metals decreases with increasing their valence electron localization, *i.e.*, from Group III to Group VI metals and, correspondingly, the stabilization of sp^3 configuration of carbon atoms decreases as well. In further studies, Samsonov took into consideration a competition between two main processes, namely localization of sp^3 configurations of carbon atoms, tending to strengthen the M–C bond, and localization of d^5 configurations of metal atoms, tending to form stable M–M bonds.

The study of physical properties of nonstoichiometric compositions of carbides was still more fascinating for Samsonov. A simple extrapolation of the above scheme made it evident that a decrease in carbon content would be accompanied by the increase in the M–M bond and corresponding decrease in the M–C bonds. The relationship between these two types of bond changes over the homogeneity range of carbides. In Samsonov's opinion, in Group IV–V transition metal carbides, the intensity of change in the M–C bond is lower than that of the M–M bond, and this uneven change is mainly responsible for the appearance of nonlinear changes in the related physical properties.

The contribution of Samsonov into understanding the nature of refractory carbide alloys was rather a pioneer one. Here again he gave more prominence to the M–M bonds.

Further, he studied properties of carbides at high temperature and found out that a general theoretical interpretation of the temperature dependences of electrical resistivity and thermo e.m.f. in terms of his model becomes difficult in then stage of its evolution through the lack of required data on the carrier concentration in the carbides under study. Other physical carbide properties studied by Samsonov included galvanomagnetic ones, thermoemission, superconductivity, and coefficient of thermal expansion, which were adequately explained in the frame of the model proposed.

As for mechanical properties, Samsonov made a great deal of effort to relate them to the density. This was important, since the most versatile method for fabrication of carbides is sintering. In view of high temperature application of transition metal carbides, much interest was devoted to temperature dependence of hardness up to 2000 °C.

Then, it was established that the residual energy after deformation is the driving force for recrystallization, and, thus, the recrystalization temperature must be related to the energy of interatomic interaction, which, in turn, is a function of the electronic structure. For transition metals, the activation energy was found to increase with increasing SWASC of d^5 cofigurations. A similar behavior was noticed by Samsonov in carbides, where with decreasing carbon content the activation energy decreases.

The first Samsonov's work on cold pressing of carbides was reported in 1955 and the one on hot pressing in 1959. In the latter, he showed that the activation energy of sintering process during hot pressing increased with the d^5 SWASC, which is related to the decrease in the fraction of non-localized electrons participating in the electron exchange.

As for a liquid phase sintering of carbides, Samsonov regarded it as an active electron exchange between solid and liquid materials owing to the strong disturbance in the electronic localization in the liquid metal, which tends to become restored by external capillary forces. An analysis of experimental findings revealed that refractory carbides are practically not wetted with metals of IIIB-VB subgroups but are, in general, wetted with transition metals. The metals that do not wet carbides have completely filled or empty *d* shells, whereas the transition metals that wet carbides, have uncompleted *d* shells. The adequate wetting of group V-VI transition metal carbides by iron group metals and manganese melt may be explained by possible capture of non-localized valence electrons of melted metal atoms by the disturbed configurations of carbon atoms in the carbides.

Samsonov's electronic approach to sintering was a fresh viewpoint, which happily avoided any wrangle between research teams of the plastic flow and diffusion schools and thus enjoyed a general approval. One can see the only limitation in the semiquantitative results of the approach, but, at the same time, it may be struck that the available quantitative pictures are pretty invalid for real systems. Samsonov wrote, "*Today there are a few sintering theories, but the principles on which they are built up are not uniform. They give predominance to diffusion processes, surface tension, etc. Evidently, the development of the sintering theory in each of these and many other trends is useful and necessary. Soon the time will come when the need for unification of sintering principles will appear. This need is of dielectric nature, connected with the transition of quantity into a new quality*." This Samsonov's statement will undoubtedly inspire the future generations of scientists engaged in the area of sintering to achieve new good results.

SCIENTIST OF THE WORLD

In fact, we are shipwrecked passengers on a doomed planet. Yet even in a shipwreck, human decencies and human values do not necessary vanish. We will go down, but let it be in a manner to which we may look forward with dignity.

Norbert WIENER

I met Grigorii Valentinovich when, full of enthusiasm but almost without any experience, I started going along the path of science. For me, up to then, he had been only a name on the covers of the books I studied from, a scientist of world reputation who I had often heard of. He seemed to me as a legend. I imagined him to be an aloof and whimsical scientist who spent his time only with himself or with a narrow circle of his closest collaborators. But he proved to be, first of all, man and he appreciated man above all. I was astonished with the way he received me for the first time in Kyiv — simply as a colleague equal to himself. He told me what would be of interest for me to work at and how to work, but I left his place under the impression that we together had decided what should be done, since his pieces of advice were not in the least some didactic directions but like part of a chat between friends. As known, only great men can be unobtrusive with their knowledge.

He was a person who never recognized the existence of any barriers, no matter mysterious labyrinths of science or, at times, strange and hard life situations were in question. He could work without breaks. Sometimes it was in defiance to very Nature.

I cannot help recalling how vividly he discussed, during his last stay in Herceg-Novi, 1975, on the chance existence of life on Earth, the courses of the battle between progress and entropy, inevitably extending in the world and encircling us directly, and on the life defying the flow of ever increasing entropy. It seems to me now he fully understood that only a man aware of the coming end of his physical existence can comprehend the essence of life. However, a volcano of optimism went on boiling in him. Intellectual pessimism, so characteristic for us, Slavs, was alien to him. His love for science was passionate. He believed that science should not be a

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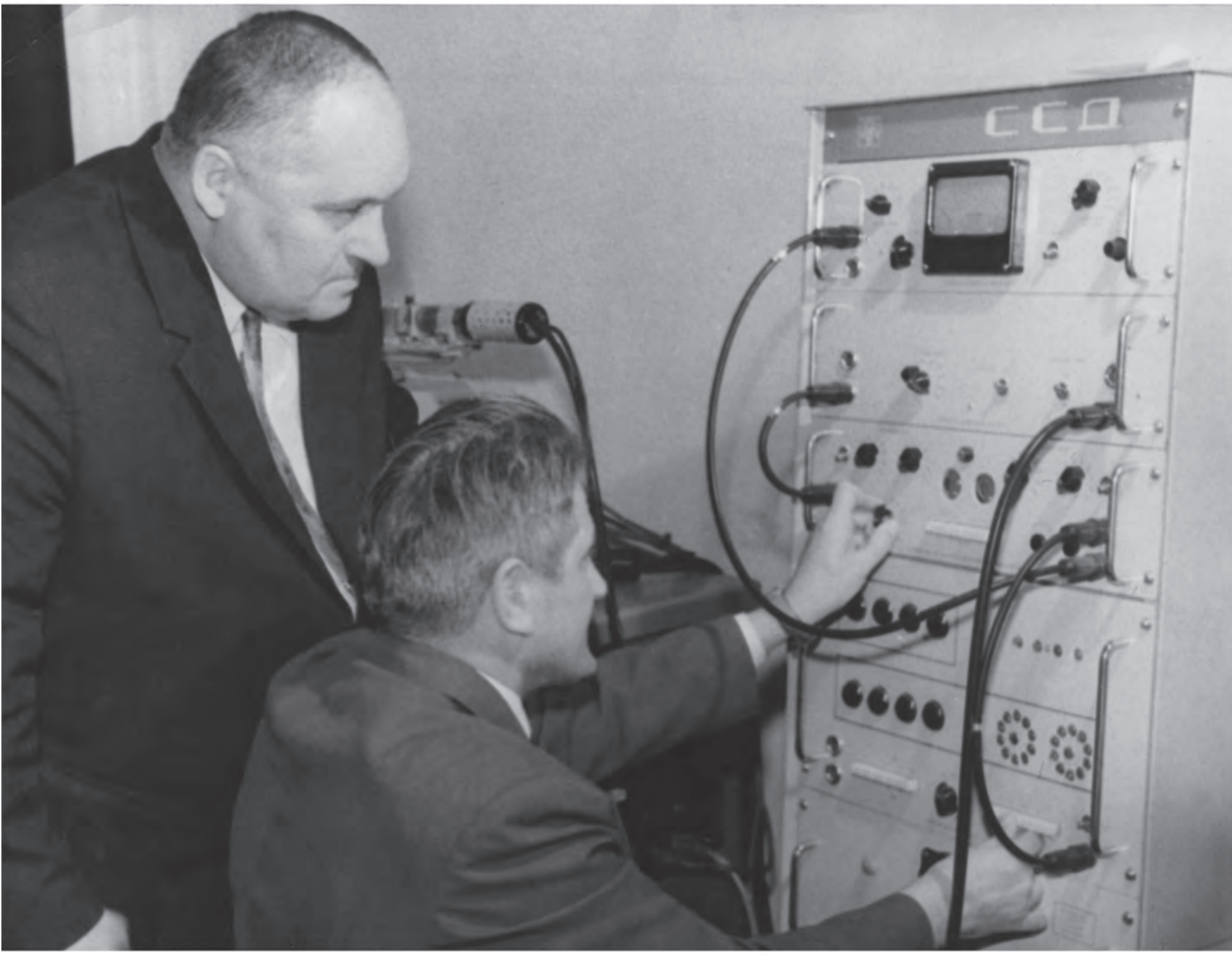
kind of property of a narrow circle of people anxious to fulfill their wishes for personal intellectual delight, self-satisfaction, and ambitions, but it should be applicable to practice, serving mankind. He was a great advocate of the "technologization of science". During our discussing the last version of the monograph "Activated Sintering", he said, *"Well, well, everything is OK. Yet we should add a final chapter dealing with practical aspects of activated sintering in order to make everyone understand for what the monograph was written, and this should be the crown of everything."*

Samsonov was an excellent lecturer. As we often met each other at scientific conferences, I can evidence how he succeeded in turning dry texts, written according to the strict criteria of science, into interesting and fruitful passages of sprinkling ideas. With his witty remarks he could freshen up tired listeners; with his deep thoughts he revealed the secrets of the most difficult problems; with his futuristic prognoses he aroused the imagination both of those just started going along the path of science and of scientists of world reputation. President of the Serbian Academy of Science and Art Professor P. Savich said after Samsonov's lecture delivered in Belgrade in summer 1975, "I cannot say this is the best lecture I have ever heard. The best does not exist. But believe me that up date I haven't heard any better and more interesting than this one". It is therefore no wonder that his reports were compared with poetry.

Sometimes it seems to me that he was closely familiar with every field of science and technology. He was always willing to go on discussing things outside the conference hall, in a garden or in a bar. He never made any difference between people of high scientific reputation and fresh researchers. To talk with the latter seemed to give him greater pleasure. He had subtle tact and was ready to listen to silly ideas of junior researchers-enthusiasts without any superior ironical smile.

In his free hours, after long tiring reports and discussions, he ceased to be a scientist and turned into a wonderful talker, a witty and, above all, interesting person ready to sing and dance. He was an excellent imitator, as he was a deeply observant man. I remember his toast to all his Yugoslavian colleagues-lecturers at the summer school "Materials in Electronics" (1975) accompanied with imitating the characteristic movements and traits of each of them. There was a lot of "teasing" in that, but nothing malicious.

Samsonov was an enthusiast for science, which he appreciated as much as life itself. He loved his Motherland deeply and truly, and part of his love was given to Yugoslavia. He loved honest, intelligent, and diligent people, no matter what part of the globe they belonged to. He was a citizen of the world. And as such, he will remain in my memory.


ССД

ORGANIZER

I HAD MANY TALENTED AND CAPABLE YOUNG MEN AMONG MY STUDENTS AND ASSISTANTS. SOME OF THEM HAD A GOLDEN HEAD, THE OTHERS — GOLDEN HANDS. BUT SAMSONOV WAS A RARE CASE: HE COMBINED A GOLDEN HEAD WITH GOLDEN HANDS.

Prof. G.A. MEYERSON
(Samsonov's teacher)

SAMSONOV'S CONTRIBUTION TO DEVELOPMENT OF REFRACTORY MATERIALS

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The more time takes us away from the memorable December 1975, when the outstanding scientist and teacher Grigorii Valentinovich Samsonov passed away, the more vividly comes to life his image, embodying a great talent of researcher, enormous workability, an unquenchable desire for creative search, and, undoubtedly, charisma, which attracted so many people to him. These qualities, along with high self-discipline, exactingness to himself and his employees (he defined them as colleagues) allowed him to create a scientific school and develop novel scientific trends in the field of theory and technology of refractory compounds and materials based on them.

Grigorii Valentinovich was invited to IPMS (formerly the Institute of Cermets and Special Alloys) in 1956. This invitation played a crucial role both for him and for the Institute. In the person of G.V. Samsonov, the Institute acquired an experienced experimenter, well known for his scientific work in the areas of synthesis of refractory compounds and powder metallurgy.

He absorbed profound metallurgy knowledge at Moscow Institute of Non-Ferrous Metals and Gold, where from 1948 to 1955 he covered the path from a graduate student to an associate professor of the Department of Rare Metals and Powder Metallurgy under the scientific supervision of the department head, well-known expert in rare metals Professor G.A. Meerson. His experience in teaching the course of powder metallurgy was set out in the book "Production of Iron Powder" (1957), written together with Dr. S.Ya. Plotkin, which nowadays, even after sixty years from the edition, serves as a textbook for today's students.

From personal experience, G.V. Samsonov knew that the synthesis of most refractory compounds could be carried out at temperatures much lower than their melting point and, as a result, one can obtain these compounds in the form of powders. Therefore, all technological processing of powders in order to make compact samples and products should be conducted exclusively by powder metallurgy methods. This approach determined the direction of his subsequent research.

I first met G.V. Samsonov in October 1956. During the first short conversation G.V. Samsonov offered me to start work as an engineer, and I gladly took up the offer. A short time later he proposed that I concentrate my work on a systematic study of the kinetics of hot pressing of refractory compound powders. In 1959, a branch of IPMS was founded in Zaporizhzhia, where the first semi-industrial production of a number of refractory compound powders began. To organize this production, the required technological documentation for the production site design was prepared.

At that time there was an urgent need for the production of nitrides of boron and silicon, which proved to be efficient components of materials used for thermal protection of space vehicles. For the invention of a method for producing boron nitride, G.V. Samsonov, V.M. Sleptsov and me were given an author's certificate. Soon, in 1960, the first in the USSR site for industrial production of boron and silicon nitride powders was put into operation at Zaporizhzhia Abrasive Combine, with the participation and promotion of Grigorii Valentinovich. This fact stimulated exploratory research and development of similar new materials. Their unique properties interested physicists, chemists, and technologists. Having a graphite-like structure and high antifriction properties over a wide temperature range, boron nitride was successfully used as a solid lubricant in processing materials under high pressure. Sintered boron nitride proved to be transparent to X-ray radiation and, at the same time, heat-resistant when used in melting a number of metals in inert media, as well as a high-efficiency dielectric, which surpassed other previously known materials by the temperature limit of application.

The use of high pressure technology enabled the Institute for Superhard Materials of the NAS of Ukraine to create an ultrahard material based on cubic boron nitride comparable to diamond. This material was called "cubonite", well known to specialists in cutting hardened steels. The same material from cubic boron nitride under the brand name of "Borazon" was developed in the USA in the 1960th.

Meantime, an original method for processing boron nitride powder by explosion was developed at IPMS. As a result, a dense hexagonal modification of boron nitride was obtained. The material produced from this modification under high pressure had an ability of interrupted cutting, in which strong impacts occur. None of the previously created superhard materials for cutting hardened steels had exhibited such high impact strength.

I cannot but mention another interesting inorganic compound, boron carbide, in which G.V. Samsonov showed interest throughout his life, beginning with his studies at graduate school, when he made hot-pressed boron carbide tablets to control rods of a nuclear reactor. This compound in the natural state contains a sufficient quantity of boron isotopes with the atomic number 10, which actively absorb thermal neutrons. The absorption, causing the fission of uranium nuclei, allows maintaining the nuclear reactor power at a required level. Boron carbide possesses a number of other valuable properties. In a compact state, its density is lower than that of aluminum and its alloys, which makes it possible to obtain from it lightweight products characterized by high hardness which exceeds that of all previously known inorganic materials, except for diamond and similar materials obtained by high pressure methods. The high hardness of boron carbide allows using it as a high-performance abrasive material in the form of powder or abrasive cloth. On its basis, lightweight armor to protect people from the damaging effects of firearms was manufactured.

On Samsonov's initiative, methods for the production of boron carbide B_4C of various degrees of purity and particle size were developed. In particular, the conditions for carbonothermic reduction of boron anhydride were substantially elaborated, and a method for magnesium-thermal reduction of boron anhydride was developed, which made it possible to obtain boron carbide in the form of an ultrafine powder.

After putting the Zaporizhzhia site into operation, I at last began to investigate the kinetics of hot pressing of carbide and boride powders. G.V. Samsonov tried to facilitate this work in every possible way, since, in addition to purely scientific interest in the very process of hot pressing, which combined traditional for powder technology processes of pressing and sintering, this method enabled fabrication of compact samples in the form required for studying physical and mechanical properties of refractory compounds.

Then, we carried out a large enough scope of systematic studies of the kinetics of hot pressing of powder titanium, zirconium, and tungsten monocarbides, molybdenum semicarbide, diborides of titanium, zirconium, and chromium, titanium-chromium diboride, titanium nitride, molybdenum disilicide, and carbides of boron and silicon in graphite moulds *via* varying temperature and pressure conditions.

The obtained array of experimental data formed a basis for further theoretical generalization and quantitative description of processes under study. Using the method of hot pressing, specialists of the Institute under Samsonov's guidance developed and fabricated various products of boron carbide and boron carbide alloyed with silicon carbide, such as nozzles of sandblasters, rods (pencils) for abrasive wheels, large-sized wear-resistant inserts of molds for pressing powders and calibrating sintered metal products, high-pressure chambers from titanium-carbon hard alloy, and hot-pressed indenters from a composite material based on boron carbide, to measure the Vickers hardness of carbides and borides within 800-1800 °C as well as the microhardness of these compounds in the temperature range of 800-2000 °C.

G.V. Samsonov relentlessly directed the efforts of his associates to a comprehensive study of conditions for synthesis of virtually all classes of refractory compounds, which served as a reliable footing for the creation of physicochemical basis for the formation of refractory compounds. Fundamentally new methods for the production of borides were developed, such as reduction of metal oxides by boron in vacuum and by boron carbide (so-called borocarbide method). Such methods as the reduction of metal-boron mixtures by carbon or by metallic and hydride reducing agents were studied as well. Also, there were successfully elaborated various methods for obtaining carbides of rare (including rare-earth) metals. The technologies for producing metal nitrides through the direct action of nitrogen, ammonia, and their mixtures on powders of the related metals as well as reduction of metal oxides by various reducing agents, in particular by carbon in the presence of nitrogen, were developed and delivered to indusry application.

To obtain silicides, a direct synthesis method was studied through heating mixtures of metal-silicon powders as well as through direct reduction of metal oxides by silicon or silicon carbide. Moreover, methods were developed for the production of sulfides, phosphides, selenides, tellurides, and hydrides. In particular, phosphides were prepared *via* reduction of metal oxides by phosphine.

At the same time, the chemical, physical, and technological properties, along with processing conditions concerning the above mentioned compounds, were studied in detail, and methods for their chemical analysis were elaborated.

G.V. Samsonov organized special teams of young experts aimed at investigating synthesis of the compounds, their crystal structure, and electrical, thermal, and mechanical properties. In the first half of the 1960th, five new structural departments were created on the basis of the initial Samsonov's department, which formed a sector in the structure of IPMS. In the sector, along with refractory compounds, intermetallic compounds were studied and methods for preparation of aluminides, beryllides, and other similar intermetallics were developed.

Based on the results of the work under Samsonov's supervision, more than 400 refractory compounds in the form of powder were obtained, which made it possible to introduce such new components into the production of various composite, structural, heat-resistant, and high-temperature materials, which significantly improved their properties.

In 1959, at Donetsk Plant of Chemicals, a site for production of refractory compound powders of reactive purity was created, which soon became a well-equipped workshop producing seventy names of powders (borides, carbides, silicides, sulphides, *et al.*).

Along with the synthesis of powders, extensive research was carried out on compacting powders using methods for pressing in molds, isostatic cold pressing, extrusion forming of mixtures of powders with plasticizers; slip casting, hot casting, and frosting of thermoplastic masses. The use of compaction methods without application of pressure made it possible to obtain articles with a uniform density of over 80 % of the theoretical one. These methods have been successfully implemented in the industrial production of a number of materials and products that possess such properties as heat and corrosion resistances in aggressive liquid and gas media.

Investigations into the stability of sintered materials based on zirconium diboride, titanium carbide, molybdenum disilicide, and silicon carbide in melts of steel, non-ferrous metals, matte, and glass opened the possibility of using them as protective jackets for metal thermocouples or electrodes in high temperature thermocouples. The industrial production of such thermocouples was organized in 1964 at Brovarskyi Powder Metallurgy Plant. Additionally, a wide industry application was arranged for sintered products from materials on the basis of titanium and zirconium diborides, such as aluminum evaporators used in deposition of thin aluminum layers on polyethylene-terephthalate films, fabrics, or paper. The industrial technology for manufacturing evaporators from the developed in the sector zirconium diboride alloy added with 5% molybdenum was also introduced in practice at Brovarskyi Powder Metallurgy Plant.

The results of investigations into a complex of properties of sintered nonmetallic refractory compounds revealed that these materials are resistant to abrupt temperature changes and exhibit high electrical insulation properties as well as resistance to the action of various molten media and their vapors. Aluminum nitride and composite materials based on silicon nitride (Si_3N_4–SiC, Si_3N_4–Al_2O_3, Si_3N_4–MgO) have high fire-resistence properties in combination with high thermal stability, hardness, electrical resistance, and mechanical strength. They are stable in molten aluminum, zinc, and glass, in contact with sulfides of zinc and antimony, do not react with alkali metals and their salts at 500-1100 °C as well as with iron oxides and iron sponge at 1000-1100 °C. Sintered products from boron carbonitride were characterized by high electrical insulating properties, resistance to frequent and abrupt temperature changes, and high corrosion resistance. Test results showed that these materials are promising as refractories and insulators for high temperature technology.

Successful development of new materials based on refractory compounds required thorough investigation of their physical properties and establishment of correlation between the properties, structure, and composition of the material.

Since refractory compounds exhibit high brittleness at room temperature, it was difficult to make compact samples of complex shape from them. In addition, it was important to know their properties at high temperature and pressure. To meet these challenges, in the sector led by G.V. Samsonov, special installations were designed and made for measuring electrical and thermal conductivity, thermoelectric characteristics, coefficients of thermal expansion and radiation, and emission characteristics of materials in the temperature range from 20 to 2500 °C. Using this equipment and new developed methods for determining the thermoelectromotive force, Hall's effect, and magnetic characteristics, numerous experimental data were obtained, which were generalized and systematized in published scientific articles, monographs, and reference books. The results of the works were used in the development of new generation of cathode materials based on hexaborides of rare-earth elements ae well as in the development of materials for thermoelectric devices.

Moreover, the regularities of evaporation of a series of refractory compounds up to 3000 K, were established. Also, thermodynamic properties of hexaborides and rare-earth chalcogenides were studied. Along with experimental studies, theoretical work was carried out to calculate thermodynamic properties of gases using the molecular constants and data on the thermodynamic properties of related compounds. Thermodynamic calculation was performed for equilibria in the "refractory compound/oxygen, nitrogen, carbon, or metal" systems in the temperature range 300-2500 °C. The equilibrium vapor tension for boron, nitrogen, and silicon was determined through the dissociation of borides, nitrides, and silicides.

On Samsonov's initiative, searching and applied research started regarding methods for deposition and properties of wear-, heat-, and corrosion-resistant coatings made *via* deposition of refractory compounds onto metals, alloys, and nonmetallic materials. This work is still going on. The result of this scientific direction is the development of technology and materials for diffusion, plasma, detonation, electrospark, and electrolytic deposition of coatings. The works have come out of the walls of Institute and are in progress at various scientific institutions in Ukraine and abroad.

G.V. Samsonov considered the action of various external effects on refractory compounds as an efficient means for changing their electronic and crystalline structure and thus opened the way to the creation of new promising materials.

All the above is far from a complete list of the results obtained over many years of work in the theory and technology of refractory compounds under Samsonov's supervision.

G.V. Samsonov scrupulously followed all the novelties published in journals on refractory compounds. When writing his articles, he considered it unethical to miss, that is to ignore, any work published in the world scientific literature.

Samsonov began to generalize this huge array of experimental and theoretical findings from the standpoint of the electronic structure of matter in order to finally create the scientific basis of materials science, guided by which it could be possible to create materials with specific predetermined properties. He left a large scientific heritage: organized large scientific groups developing the scientific trends initiated by him; wrote a great number of scientific works, including a series of unique monographs in all areas of his scientific activity, several thousand scientific articles, hundreds of patents, and a number of valuable reference books.

G.V. Samsonov read a lot, and not only scientific literature. He was an erudite and witty man. He possessed a very strong intuition, he could unerringly determine the direction of promising researches. Following the classification of human character types established on the basis of Swiss scientist Carl Jung's studies, I dare say that the psychological type of Samsonov is an intuitive-logical extrovert endowed with a high intellect. Psychologists called this type "Don Quixote", and (what a coincidence!) G.V. Samsonov truly liked this character from the novel by Cervantes. Describing people with an intuitive character, Jung wrote that these people are "eternal plowmen." Unlike people with a developed sensory function who upon tilling their fields, carefully guard them, an intuitive person, having completed one field, immediately takes up another, and the results of his work are often used by other people. This quality is so well suited to G.V. Samsonov, an "eternal plowman" on the field of science.

Many years have passed after his departure for ever, but he remains one of the most cited authors in the world scientific literature. His personal contribution to the development of works on the theory and technology of refractory compounds and materials based on them is invaluable.

THE INSPIRATION

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More than 40 years have passed since Grigorii Valentinovich Samsonov untimely died. Everyone who was young when communicating with him today is much older than he of that time. Nevertheless, we, his followers, remember him as a senior mentor and teacher.

Grigorii Valentinovich was a bright, charismatic, and multifaceted person, and my memories of him revive the feeling of romance of that time, full of aspiration to the future, and great gratitude to him for the inspiration to the cause which subsequently became the cause of my life. It was namely inspiration, not mere communion, as with his energy, will, and charisma he inspired all his disciples to significant deeds. The publication of the memories about Grigorii Valentinovich is important not only as a tribute to this outstanding scientist and organizer of science, they are also important for subsequent generations, which should know about the time when, in very difficult circumstances, something new was created for the country's engineering progress.

All my work experience is related to the researches initiated by Samsonov and aimed at achieving definite results in developing production processes and technologies.

Grigorii Valentinovich communicated with numerous domestic and foreign scholars. I would like to underline his role in the arrangement of the first in the country unique industrial production of powdered refractory compounds, which, due to their exceptional properties, are of much interest for the development of current technology.

After graduating from the Faculty (school) of Physics at Ivan Franko Lviv University, I was sent to Donetsk Plant of Chemicals, the largest plant in the USSR specialized in the field of fine chemicals technology, where shortly after a research group was organized to develop methods for the production of refractory compounds, such as borides, carbides, nitrides, and silicides of metals. The reason for the creation of such a group was the special resolution of the USSR government on the creation of industrial production of refractory compounds with the so-called "reactive" purity for the needs of space and nuclear power engineering, as well as for chemical and mining industries of the USSR.

I was attached to this group. The work was conducted in close cooperation with IPMS. Everything that the group did was significantly different from what was done at the plant as a whole. High temperature (up to 2200 °C) processes and electric vacuum equipment were as a "white crow" against the background of liquid processes in the production of chemicals. The task for the group was not only to master the technology for obtaining refractory compounds, but also to develop such processes and equipment that could provide the opportunity of their production with hundreds and thousands of times greater quantities than the available laboratory techniques could do. On the way to this, we encountered a lot of difficulties. High pyrophoricity and fire hazard of the original metallic powders of Mg, Al, Ti, Zr, and Hf required a special approach to the arrangement of work with them. There was no similar production in Ukraine and the USSR. Foreign firms, where the research and production of refractory compounds had been actively developed, the know-how for refractory compounds was carefully concealed. We had to start in the absence of any experience and knowledge in this area. But, as they say, the way is covered by the going.

Under such conditions, it was very important to get a charge of confidence in the significance and promise of the business initiated. Grigorii Valentinovich, a man who radiated energy, freedom, and confidence, became for all of us, young engineer-researchers, such a supporting pillar. I remember how in the first months of work I was sent to Kyiv to consult Grigorii Valentinovich. He warmly accepted me and at once offered a subject of my future candidate dissertation, of which I was very flattered and enlightened. A research program was drawn up and work began.

Thanks to the active participation of Grigorii Valentinovich's department staff, laboratory equipment for the production of refractory powders was created at the plant with small electric vacuum furnaces, provided by IPMS.

Later on, while communicating with Samsonov, I could not but be amazed at his workability, responsibility, efficiency, and a great interest in obtaining, as it seemed to me, even insignificant results. I sent him reports on the work done and, literally, within three days I received replies with a benevolent assessment and new proposals.

Grigorii Valentinovich was aware of the importance of creating refractory compounds as a base for the development of new materials capable of working under extreme conditions.

The government encouraged works in this direction. A big school for all of us, dealing with refractories, was the participation in the work of the Coordination Council on Powder Metallurgy at the State Committee on Science and Technology under the USSR Council of Ministers, in particular in the section of refractory compounds. In accordance with the section program, quarterly scientific conferences were organized in Kyiv, Moscow, Leningrad, Minsk, Riga, Sverdlovsk, Novosibirsk, Yerevan, Tbilisi, and other cities of the USSR, at which the participants informed on their findings in the field of technology and properties of refractory compounds, took part in the organized excursions to local research laboratories, and thus got aquainted with pilot production of refractories there. Each of the participants received first-hand information on the state of affairs in the field that interested him. Grigorii Valentinovich coordinated and organized the work of the section council and presided at the meetings.

Seeing certain positive results, the plant management encouraged the work of our research group. To a large extent, it also was promoted by the fighting spirit and leader's qualities that Grigorii Valentinovich had instilled in us. He visited the plant in every possible way.

Meanwhile, continuous processes were developed for synthesis of refractory compounds, and required electrovacuum equipment for the formation of aerated and vibro-displaced layers, mechanical activation of synthesis processes, liquid-phase interaction of initial components, and production of monocrystalline compounds was manufactured.

The organization of industrial production of a wide range of refractory powders at Donetsk Plant of Chemicals greatly contributed to the development of powder metallurgy in Ukraine and gave a powerful impetus to the creation of new high-performance materials by other research institutes and design construction bureaus. Grigorii Valentinovich Samsonov played an outstanding role in the implementation of this program in practice.

In June 1974, Grigorii Valentinovich arrived in Donetsk to the opening of the metallurgical conference. Naturally, I met him and accompanied about Donetsk. The following day he was to participate in the meeting of Dnipro's metallurgists and asked me to take him to Dnipro. Three years before, the plant presented me, as a promotion, with the opportunity to acquire a Zhiguli car. As a happy owner of the first Zhiguli model, I agreed gladly, anticipating the brillant chance to communicate with my idol for several hours on our way to Dnipro. My wife prepared a good portion of chops and filled a liter thermos with ice cream. I grabbed 0.75 l of cognac. At 6:00 AM Grigorii Valentinovich was already waiting for me at the hotel "Shakhtar" and we went on a journey. Somewhere halfway, we chose a secluded place by the road and arranged a halt. Grigorii Valentinovich, with ease and pleasure, overcame 0.75 l of cognac (he was a big and strong man), ate some bacon and ice cream, and was much surprised at from where I knew exactly what kind of binge and food he liked. Grigorii Valentinovich told me how he studied, how he participated in World War II, how he met and fell in love with his wife as well as about the environment at work. Such a revelation for me was unexpected and surprising. It turned out that Grigorii Valentinovich, with his externally imposed strictness, was a sincere and very vulnerable man. Among other things, he mentioned that I should prepare and uphold my doctoral dissertation as soon as possible, because... "Who will help you if I don't?" It was strange for me to hear that, seeing in front of me a handsome, strong, and energetic man.

A year later, Grigorii Valentinovich was gone. The best memory of him is tens of his books kept on my book shelves, which I often turn to.

THE ORGANIZER AND LEADER OF WORKS IN THE FIELD OF PROTECTIVE COATINGS

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Throughout his creative scientific activity, G.V. Samsonov paid special attention to the development of works in the field of protective coatings.

The first studies on the application of protective coatings carried out under the guidance of G.V. Samsonov refer to the 1950th, *i. e.*, to the period of his scientific work at the Department of Metallurgy of Rare Metals at Moscow Institute of Non-Ferrous Metals and Gold. They were devoted to boronization of iron and steel and to diffusion saturation of refractory metals with boron, nitrogen, and silicon. Later in Kyiv, at IPMS, he supervised studies on diffusion boronization of coal-plough machine components, which yielded important practical results, namely an increase in the service life of components by 3-4 times. At the same time at G.V. Samsonov's department, for the first time in the former USSR, a laboratory installation for deposition of coatings using a detonation method was designed. It should be noted that the then works in this direction were carried out in the USA only (firm "Union Carbide"), but their method, equipment, and technology were patented and practically inaccessible. However, in spite of the lack for necessary information, this method was independently mastered at IPMS, and under Samsonov's guidance, V.I. Shesternenkov defended the first candidate dissernation devoted to detonation deposition of coatings. The created detonation equipment attracted interest among representatives of various organizations, including foreign ones.

In 1965, the first in the USSR laboratory of protective coatings was organized, where wear-, heat-, and corrosion-resistant coatings were investigated using various methods for deposition. To lead this laboratory was entrusted to me, a young candidate of physical and mathematical sciences.

Under Samsonov's guidance, twenty candidate dissertations on obtaining protective coatings on refractory metals, steels, and nonmetallic materials by various methods were defended. In those years, no other scientific or higher educational institute of the former USSR carried out such a broad front of works on protective coatings as IPMS did.

G.V. Samsonov conducted a large scientific and organizational work to promote and coordinate studies in this field. In 1962, as Head of the Department of Physical and Technical Problems of Materials Science at the Academy of Sciences of the Ukrainian SSR, he organized a permanent seminar on diffusion saturation and protective coatings and publication of the proceedings of this seminar in the publishing house "Naukova Dumka". The interest in the seminar grew from year to year, as evidenced by the ever-increasing number of its participants and interest in the seminar's proceedings not only in the USSR, but also abroad.

In total, more than 100 different organizations took part in the work of the seminar. Many collections of reports were reprinted in other countries, in particular in the United States and India. Among the seminar participants were scientists with a world-wide reputation, representatives of design bureaus and factories, who made agreements on joint work with us on the introduction of scientific research results into industry.

G.V. Samsonov was the chief editor of the journal «Protective Coatings on Metals". With him, three monographs on protective coatings were published. G.V. Samsonov was the first to draw attention to the fact that coatings deposited onto an article not only improve its performance characteristics, but also create a new composite material that does not represent a mere sum of the characteristics of substrate and coating but exhibits qualitatively different, often very high, physicochemical and mechanical properties. Therefore, the chemical-thermal treatment should be considered not as a certain subsequent product processing like heat treatment but as a method for creating principally new materials.

One of Samsonov's reports (at the seminar devoted to consideration of diffusion processes at the subatomic level) was based on the concepts of the configuration model of matter. He analyzed the parameters of heterodiffusion in metal-metal and metal-nonmetal systems and showed that the activation energy and the diffusion coefficient are determined by the nature of electron exchange between the atoms of diffusing substances, herein the activation energy decreases with increasing probability for formation of energy-stable configurations in the atoms. The structure, nature of defects, and atomic radii, which are uniquely determined by the electronic structure, are secondary properties of the substance, *i. e.*, are not determining factors in diffusion processes.

G.V. Samsonov constantly stressed that it is possible to successfully solve the entire complex of practical problems only by relying on well-substantiated theoretical assumptions and results of pilot researches. That is, to develop the theory of protecting metals against corrosion, wear, and other effects, it is necessary to draw on the achievements of modern quantum physics and mathematics.

Paying much attention to coordination of works in the field of protective coatings, G.V. Samsonov was the initiator of organization of the Scientific Coordination Council "Protective coatings on materials", as well as an institute specialized on coatings. In 1966, on his initiative, the section of refractory coatings at the USSR Academy of Sciences was organized, which involved leading experts in the field of protective coatings.

In the late 1960^{th}, scientific and engineering cooperation on the problem of protective coatings reached the international level. Scientists from IPMS participated in joint work of the CMEA countries (former Hungary, the GDR, Poland, Cuba, and Czechoslovakia) on the project of the VI CMEA "Development of technology for production of protective coatings by thermal spraying, immersion in melt, and enameling."

The products of the cooperation include, in particular, new composite powders, new equipment for plasma spraying and electric arc metallization, CMEA standards for technological conditions and methods for controlling metallized corrosion-resistant coatings, terminology for gas-thermal spraying, catalogs for thermal equipment and powders produced in the CMEA countries for gas-thermal spraying and surfacing, and much more.

Samsonov's ideas in the field of protective coatings have found their further development in the works of his numerous followers. Many of them have created their own schools and, using the fundamental ideas of their teacher, go on deepening and developing them to discover new areas of protective coatings application.

Fortunately, Samsonov's scientific works have not lost the relevance up to date, they go on serving for the progress of various fields in science and engineering.

IN MEMORY OF OUTSTANDING SCIENTIST AND WONDERFUL MAN

M.V. Novikov
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I closely touched with G.V. Samsonov when he was Deputy Director of IPMS, and I, an "as-baked" candidate of science, an employee of the Department of Strength, was elected secretary of the Communist party organization at the Institute. Before that, I had had an opportunity to make the aquaintance with him regarding a wall newspaper for the Institute. I noticed at once that in organizational matters G.V. Samsonov was a clear, demanding, and tough leader. Practically from scratch he had to create laboratory equipment, determine the scientific trend, select and train associates.

He worked everywhere: at institute, at meetings, at hotels, and even in car. He always carried a thick briefcase with books and journals and never wasted time. Just on sitting down, he started looking through fresh scientific papers. Immense erudition and intuition prompted the solution of urgent problems. He liked to analyze a heap of facts, to make bold conclusions, to attract students' attention to new interesing tasks. And as a result, the monographs "Phosphides", "Nitrides", "Germanides", "Borides", "Berillides" and so on appeared thanks to his participation and support. Their significance as capital directories and analytical generalizations is still very great.

He was fluent in French and German, understood English, and thus absorbed a huge volume of foreign scientific literature. To know world science, to direct the activity of employees to new tasks, to search for the right and rapid analytical or experimental solutions of current problems in any accessible way was his standard of life.

G.V. Samsonov was a participant in World War II, served in staffs, field troops, so he was punctual, clear in action, and resolute in making urgent decisions.

From 1962 to 1964, I worked with Samsonov as Head of the Department of Physical and Technical Problems of Materials Science at the Academy of Sciences of the Ukrainian SSR. There were many strategic projects and much initiative. Sorry to say, great attention was paid to the personnel problems, because the sharp and demanding style of

G.V. Samsonov' supervision was not at everyone's taste. It was necessary and hard for me, then a consultant of the science department at the Central Committee of the Communist Party of Ukraine, to understand hot disputes, for example, between G.V. Samsonov and V.N. Bakul on the promising technology for obtaining the cubic phase of boron nitride.

Nevertheless, most of the scientists were attracted to G.V. Samsonov's high culture, erudition, knowledge of the languages and customs of European countries, his smile, and sparkling humor. These qualities made it possible to defuse any complex situation that arose from the difference in the positions of interlocutors. I frequently participated with G.V. Samsonov in meetings with foreign scientists. His authority was especially respected by the Belgrade scientists. In the last decade, we met less often, so the news of Grigorii Valentinovich's departure from life in the prime of his creative power was unexpected, and the loss was hard.

I am proud that the monument to G.V. Samsonov was made at our institute, and one of his bright students, P.S. Kyslyi, became an Academician at our institute as well. Many other Samsonov's disciples are working here today. We are all grateful to G.V. Samsonov for his creative heritage and fruitful ideas for developing superhard materials.

SAMSONOV'S ACTIVITY AT KPI

P.I. Loboda

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In the second half of the XXth century, alongside with the advent of the era of aerospace industry and nuclear power, a question arose concerning the training of experts in the field of powder metallurgy who could have a methodology for the creation of high temperature multifunctional materials capable to operate under extreme conditions. That is why in 1962, the department of high temperature materials and powder metallurgy was created at KPI, and the all-world-renowned scientist Grigorii Valentinovich Samsonov was appointed Head of the department.

G.V. Samsonov paid much attention to the professional growth of scientific-pedagogical staff. Under his scientific guidance, in the possibly short time, candidate dissertations were defended by L.M. Vermenko, F.S. Garibian, F.I. Chaplygin, O.S. Yurchenko, I.I. Bilyk, V.V. Morozov, G.Sh. Upadhyaya (India), P. Lukch (Hungary), M.P. Dimitrova (Bulgaria), M.O. Voronkin, and many others.

Grigorii Valentinovich persistently worked on the improvement of curricula and the content of subjects studied at the department. Being aware of the fact that the synthesis of new refractory compounds is impossible without knowledge of the structure of crystals, which determines the physical and technological properties of refractory powders, he introduced courses on crystallography and crystallochemistry. It was the fruitful collaboration of crystallographers and researchers of the physico-mechanical properties of carbides, carboborides, carbonitrides, hydrides, *etc.* that allowed students to subsequently work systematically and purposefully on the creation of fundamentals of materials science for powdered and composite materials.

As Samsonov stated, in order to obtain reliable findings for physical characteristics, the most expedient route is to study single crystals. The first approach to them was samples of molten poreless refractory compounds. Therefore under his supervision laboratory works on obtaining molten refractory compounds and their alloys started.

Grigorii Valentinovich initiated fundamentally new directions of research, which have not lost their relevance and are still successfully being developed today. One of them is the creation of materials for emission electronics. Under his guidance, the department researchers developed the physicochemical fundamentals of technology for the production of boride phases of rare-earth metals and products of them.

The practical results on plasma technology for deposition of emission coatings from lanthanum hexaboride for cathodes of high-current generators of electrons and various other technological products were introduced in the All-Union Research Institute of Current Sources (Moscow). Sintered cathodes from lanthanum hexaboride successfully passed special tests at Kurchatov Institute of Atomic Energy (Moscow).

In 1965, Grigorii Valentinovich began his research on obtaining particularly pure refractory compounds, such as BN, GaN, AlN, and LaB_6. A fundamentally new method for obtaining monocrystalline boride and composite materials of high purity with predetermined crystallographic orientation, geometrical sizes, as well as high structural and chemical properties was elaborated. Industry-accepted technologies for obtaining single crystals of rare-earth metal borides were developed, primarily for lanthanum hexaboride single crystals, from which disk-like and T-shaped cathodes have been manufactured up date for welding, smelting, cutting, engraving, dimensional and thermal processing, evaporation, plasma warming, etc. and implemented in more than thirty enterprises of Ukraine and Russia, as well as for devices of electronic-probe analysis. Also, developed was a technology for the production of new superhard high-strength quasi-viscous ceramic materials on the basis of the refractory compounds B_4C, SiC, and borides of transition and rare-earth metals, which consist of a single crystal matrix formed by one refractory compound reinforced with discrete regular fibers of another refractory compound. The purity of the crystals obtained is higher than that of triple crystallized materials *via* using traditional techniques. The technology is characterized by high productivity and low power intensity.

For the first time, thanks to the application of new high-module directional-reinforced composite materials, direct-heated ceramic cathode elements with a LaB_6 emitter were manufactured. By the stability of spatial-geometric characteristics, they surpass the best world analogues. High strength and fracture toughness of these composites allowed one to decrease the size of cathode construction elements down to the level of metallic ones without fracture at the stage of manufacturing or subsequent operation under the conditions of irregular heating/cooling and to markedly reduce the heating power of microcathodes with ceramic structural elements, as well as to prolong the lifetime of single crystal cathodes up to 1000 hr.

Another important scientific direction of the department was the study of sintered hard alloys with improved physical and mechanical characteristics. Moreover, work was carried out on the creation of a gradient structure in hard alloy drills, molding filets, *etc*. In 1968, a new trend of researches began, namely the creation of the so-called tungstenless hard alloys, which were carried out by joint efforts of our scientists and engineers from the Chirchik branch of VNII for hard alloys and the Uzbek Combine for refractory and fire-resistant metals, under the general scientific guidance of G.V. Samsonov. In the 1969-70 years, for the first time in the USSR, the experimental production of hard alloys based on titanium carbide with a nickel-molybdenum binder started at the Uzbek Combine. In order to expand the area of using tungstenless alloys, the department simultaneously worked on the creation of alloys suitable for use under impact conditions.

Also, the full-scale production of the KNT16 alloy, developed at the department, was organized at Kirovohrad Plant of Hard Alloys. In the period of 1974-1975, at Dnipro Plant of Hard Alloys, several types of cutting plates and wear-resistant articles from hard alloys of the TN20 and TN50 grades were produced.

In 1970, under the guidance of G.V. Samsonov, first in Ukraine, work on the creation of powder tools on the basis of molten refractory compounds began. The mechanical strength of abrasive grains from molten carbides, carboborides, and carbonitride of transition metals proved to be much higher than that of sintered material grains. Besides, molten refractory compounds have a higher abrasion capacity.

A principle was proposed for creating composite magnetic-abrasive materials, in which the abrasive component from refractory compound was obtained by melting. The developed materials and devices for magnetic-abrasive processing have been defended by more than twenty copyright certificates and introduced into enterprises of Hungary, Japan, Bulgaria, and other countries.

In addition to the above, the following works have been carried out at the department:

• Creation of materials and technological processes for deposition of coatings by gas-thermal methods. One of the scientific results of this work is the development of principles for the formation of composite coatings based on molten refractory compounds. For the first time in Ukraine, protective coatings were deposited with the help of flexible powder cords. The scientists of the department took an active part in the organization of production of flexible powder cords in the USSR (Joint Soviet-French Enterprise "Tekhnikord", Moscow oblast). To manufacture composite coatings, a special binder was prepared, namely an iron-based self-fluxing alloy, which, moreover, can be used individually in coating deposition, since it has properties similar to those of more expensive self-fluxing alloy based on nickel. The technologies for deposition of such composite coatings were introduced in such plants as "Tekhnikord" (Russia), Navoin Mining Combine (Kazakhstan), and Kropyvnytskyi Turbine Plant (Ukraine).

• Development of materials and technological processes for deposition of retentional coatings for biomedical purposes, in parrticular in dental and orthopedic practice. The works in this direction were defended by 15 copyright certificates and patents for inventions and published in over 100 scientific articles.

• Creation and introduction into industry of magnetic materials. Here the idea of G.V. Samsonov about the opportunity to efficiently influence the properties of ferrites with spinel and hexagonal crystalline structure by doping them with REM oxides proved to be particularly fruitful. It was an absolutely new, original approach not only to solving scientific problems in the field of magnetic oxide materials, but also to creating new ferrites and improving the techniques for their production.

• Development of methods for obtaining alloyed ferrites through co-precipitation of the related metal hydrooxides, which allowed a significant increase in the solubility of REM ions in the spinel lattice of ferrites and in the efficiency of their influence on the magnetic properties of materials. This helped us design a new material for microcores with high impulse characteristics used in fast-operating memory elements. On the basis of studies on the influence of REM oxide addition on the properties of magnesium ferrite, new materials were obtained which efficiently work in the ferrite devices of the decimeter and meter diapasons of electromagnetic waves, for example, in phase rotators and circulators. The results of investigations of the influence of calcium oxide addition on the properties of the commercial Mn-Zn ferrites were used at Rybinsk Electrical Engineering Plant (Russia).

Under the direction of G.V. Samsonov, solution technologies for obtaining superconducting complex oxide materials were developed at the department and introduced into industry. Later this allowed us, together with the Chemical Faculty of Moscow State University, to develop a cryochemical technology for obtaining nano-structured superconducting oxide materials on the basis of the Y-Ba-Cu-O and Bi-Ca-Sr-Cu-O systems. Today, the department continues works aimed at using this technology for the production of new soft-magnetic materials with a heterogeneous structure containing nanosized inclusions.

The department preserves and multiplies the glorious traditions initiated by G.V. Samsonov. It has created an extensive system of training experts in materials science and powder metallurgy. As well-known, Samsonov was particularly attentive to young people and spent considerable time and effort on training them. Today, one of the main stages of training is a pre-university training, in which the department cooperates with the Mala Academy of Sciences and the Ukrainian Center for Out-of-School Education and publishes innovative proposals and inventions performed by schoolchildren, who in the near future will be able to carry on the materials science flagship.

THE GUIDING STAR

V.P. Bondarenko
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For every man, a few big stars shine in his life sky. These are people who have had the greatest impact on his course of life. One of such people who drastically influenced my scientific path was and remains Grigorii Valentinovich Samsonov.

Many years ago he gave us, students of KPI, lectures on the production of metal powders, organized laboratory work, and gathered other brillant lecturers. After graduating from the Institute in 1961 and subsequent work at the Institute of Superhard Materials until 1964, I decided to enter the graduate studies at the Department of High Temperature Materials and Powder Metallurgy at KPI. After my passing the entrance examinations and enrollment, Grigorii Valentinovich offered me a subject for my candidate dissertation concerning solid solutions of rare- earth hexaborides as promising materials for electronic engineering. This was a theory of solid solutions in terms of atom sizes and electronic properties of materials related to the bonds between atoms, structure of electron shells of atom, mobility of charge carriers inside a solid, and the conditions for electrons to exit into the interelectrode space of electronic devices. At that time he himself was fascinated by development of the theory of rearrangement of the atom electron shells while forming a solid body.

At one of the conversations Samsonov said, "Now all physicists are keen on nuclear processes, therefore in atomic physics stagnation is observed. Our task is to raise science of materials to a new level". He worked in this direction actively and creatively, I would say, dialectically. He started considering these items in his doctoral dissertation, where he linked the properties of refractory compounds with the structure of the electron shells of isolated atoms. Then, his graduate students (there were dozens of them) and the employees of the hed by him Sector of refractory compounds at IPMS were engaged in this problem, and Samsonov was pleased when some of them managed to contribute something to his concepts. Basing on his and his students' experimental and theoretical findings, he came to the creation of a hypothesis concerning the formation of stable electron configurations in the atoms of a solid body.

Not all physicists of the traditional trends supported that idea. Some of them drastically criticized it. However, interest in it was manifested by more and more experts working in the field of materials science of refractory compounds. Graduate students tried to interpret their experimental results from these positions, but their explanation was not always convincing, because at that time it was not possible to widely use powerful computing equipment to perform needed calculations. In addition, our knowledge of electronic processes running in solids, especially in refractory compounds, was not sufficient. As a result, conflicts sometimes arose among Grigorii Valentinovich's colleagues. They were caused by the objective complexity of phenomena under study, but at times by misunderstanding the ideas developed by Samsonov. Usually simple-minded, confident in himself, with sparkling eyes and a pleasant smile, at such moments he became furious. His loud voice rattled throughout the room and seemed to pass through the walls out. The ashtray, which he rarely parted with, flew from one end of the table to the other.

Soon I was drafted to the army. We periodically corresponded. Before the end of the military service I wrote a letter to Grigorii Valentinovich where I asked for advice concerning my dwelling in Kyiv. And he advised me to return to the Institute of Superhard Materials, since it expected to receive a large number of apartments. I followed his advice, and everything was arranged luckily. I have been working at this Institute over forty years, have moved to the Deputy Director of the Institute and Corresponding Member of NAS of Ukraine, and I recall Grigorii Valentinovich's advice with gratitude.

The knowledge he laid down, his scientific books, his students' books help me solve today's complex scientific problems. Despite the absence of deep theoretical base, his hypothesis of the formation of stable electron configurations aquires more and more adherents and followers, since it allows one to predict a number of new scientific directions important for applied materials science. It may be taken for a simplified model for the formation of interatomic bonds in simple substances and complex chemical compounds containing transition metals with unfilled *d* and *f* shells in comparison with the available sophisticated models of atomic and molecular orbitals that require long-term and complicated calculations. Samsonov's model actively worked in predicting new technical problem solutions, whereas the other models were cumbersome, difficult to understand by new-coming material scientists and thus inefficient for heuristic prediction of practical results.

In particular, the application of Samsonov's model allowed many researchers to predict a number of important practical results not only in creating materials for different fields of electronics, but also for converting chemical energy into electrical, for cutting and abrasive processing of metals and alloys, and for obtaining extremely stable or rapidly decomposing compounds. There were tens of young people who submitted and successfully defended candidate theses and shortly after became associate professors, full professors, heads of departments, and leaders of production workshops and factories. For example, I.M. Mukha, upon defending his doctoral, created a section of hard alloys at the Kyiv "Radiopribor" Plant, which provides carbide-tipped products to all radio industry enterprises of Ukraine. P.A. Boiko supervised the site of hard alloys at the Relay and Automation Plant. V.C. Vitrianiuk created the state-owned enterprise "INMA", which for the first time in Ukraine produced tons of tungstenless hard alloys. V.Ya. Shliuko, V.V. Morozov, and A.N. Stepanchuk headed the Department of High Temperature Materials and Powder Metallurgy at KPI after Grigorii Valentinovich. P.I. Loboda was the dean of the physical-technical faculty at KPI. O.S. Yurchenko chairs at Drahomanov Kyiv Pedagogical University. I.I. Bilyk is the creator of new tool materials based on carbonitrides and gives lectures at KPI. G.T. Dzodziyev organized industrial production of unique tungstenless hard alloys at the Uzbekistan Combine of Refractory and Fire-Resistant Metals, and so on.

Scientific developments carried out by G.V. Samsonov and his graduates significantly affected the formation and development of the Dnipro Combine of Hard Alloys and Refractory Metals and the firm "Svetkermet" in Svetlovodsk. Moreover, they participated in the foundation and development of materials science centers in Russia (the Urals,Transbaikalia, and the Far East).

Also, foreign scientists treated G.V. Samsonov with great respect. His idea of a radical rearrangement of the electronic structure of atoms while forming elementary substances and complex chemical compounds served as an impetus to the creation of other models as well as to the development of classical studies on the theory and spectral methods for studying the density of electronic states in solids in Ukraine and other countries of the world. It is also worth noting that G.V. Samsonov was a member of the editorial boards of many scientific journals in the world.

In medicine, his ideas have also found a deep reflection. From the positions of the electronic structure of atoms, there were examined the reactions of human body to the environment, in particular to the presence of certain harmful powders of chemical compounds, and the possibility of creating efficient drugs against their action.

Grigorii Valentinovich enthusiastically led the students' scientific society at the department of powder metallurgy, delivering interesting lectures on science prospects. Before flights of man into space, he told students from his scientific positions about superconducting power lines, high-speed railways, the structure of rocks on Venus, Mars, and other planets. The students breathlessly listened to him. As a result, many of them, having changed their previous life plans, came to science.

His ideas on the stable sp^3 electron configurations of carbon atoms have firmly settled in the science of synthesis of diamond and other superhard materials. Basing on them, he predicted the unique properties of the BNC compound. Yet during his lifetime, the industrial production of BN and BNC was set up. Using high pressures, the scientists of the Bakul ISM have obtained the superhard material BC_2N.

Grigorii Valentinovich early departed for ever. Being unwell, he continued to work actively, without slowing down, instructing, activating, supporting, helping others. Even today, he is invisibly present among scientists and helps them find their way in the ever-expanding and more complicated labyrinth of scientific research in the area of materials science.

ABOUT G.V. SAMSONOV

S.S. Ordanyan
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The Department of Ceramics at Saint-Petersburg State Institute of Technology (formerly headed by Professor A.I. Avgustinik) started developing new materials using anoxic refractory metal-like compounds in 1959. This group of substances was new for the department. The basic information was only drawn from the books "Solid alloys" by R. Kieffer and P. Schwarzkopf and "Solid compounds of refractory metals" by G.V. Samsonov and Ya.S. Uman skii. However, the specific task facing the department, namely the development of high temperature structural materials based on carbides of zirconium, niobium, *etc*., required additional information. But then neither the technological nor the physicochemical aspects of the solution of this problem were coordinated. Therefore in 1960 I was sent to Kyiv, to Professor G.V. Samsonov for consultations.

I talked with him about the tasks that we had to fulfill using carbides of zirconium and niobium, which were scarce at that time even for research purposes. Full of respect to his business, I did not dare address him problems related to specific items of studies and compensated this part of relationship by talks with his graduates. But (amazing Samsonov's attention!) from 1961, starting with New Year's wishes and then on, I received greeting cards from him for all festive days until 1975.

In those years dense ceramics from anoxic refractory compounds were obtained by hot pressing, which was not used at our department. The needed carbide products were of a complex shape, getting which was very problematic. It was necessary to urgently develop methods of "free" sintering, which could provide the fabrication of dense products of complex shape. This problem was solved through vibrogrinding carbides, changing their stoichiometry, selecting special media for grinding, using special surfactants in molding by various techniques in order to control the rheological parameters of the mixtures treated.

It should be noted that during this period our contacts became so close that graduate students from IPMS frequently visited our Institute with reports on their candidate and doctoral dissertations.

Moreover, one of the most talented Grigorii Valentinovich's students, V.S. Neshpor, was employed to work in the Russian Research Center "Applied Chemistry" in Saint-Petersburg. Until 1990, an intense and fruitful research was conducted on the creation of a large group of high temperature structural materials and special purpose products. Besides, a comprehensive study of the properties of group IV–VI metal carbides, their solid solutions, in particular carbonitrides, was carried out. In joint research, experts from Keldysh Scientific Center, GIPKh, PNITI (Podolsk), the Institute of Solid State Chemistry (Sverdlovsk), *et al.* took part. The study of electrical conductivity, thermal conductivity, elastic characteristics, creep, and other properties in the temperature range of 2000-2900 °C significantly increased the range of construction materials and products from them.

When information on the regularities of the interaction of carbides, nitrides, diborides, and oxides with transition metals was collected, I attempted to generalize it on the basis of evident correlations in eutectic systems among the eutectic temperature, composition, and the parameters of the electronic structure of Me and X, introduced by G.V. Samsonov in his configuration model of matter.

Being aware of the prospects and importance of creating nanostructured materials based on refractory compounds, I recall the exciting seminars conducted by G.V. Samsonov on the issues of the accelerated development of plasmochemical synthesis and methods that could allow obtaining all groups of refractory materials in the ultrafine state. Such seminars helped establish long-term creative and fruitful relations with researchers of the Institute of Inorganic Chemistry of AS of Latvia.

All the books published on Samsonov's initiative have been used up to date in lecture courses training students on the specialty "Engineering Ceramics". All graduates from our institute deeply respect the name of the coryphaeus who formed understanding that the development of many branches of current technology may get into the stage of stagnation without involving refractory compounds in creating advanced materials.

I am lucky to have stepped on the path of developing new materials to be used under extreme conditions, which was inconceivable without the ideas and substances developed and promoted by G.V. Samsonov.

ON THE DEPARTMENT LED BY G.V. SAMSONOV

V.I. Ivashchenko
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G.V. Samsonov organized the work in his department at IPMS, "Physical materials science of refractory compounds", in such a way that the triad "technology-structure-properties" could be realized. This required not only the development of new technology for obtaining promising materials and articles of them, but also investigation of their physical and mechanical properties needed for the subsequent industry application. Therefore the employees of the department were divided into many scientific teams (official and non-official laboratories) working in different areas in the same major direction of the department. Such an approach made it possible to produce a great deal of new promising compounds and materials, among which we can mention cathode materials of new generation on the basis of hexaborides of rare-earth elements (Yu.B. Paderno), materials for transformation of thermal energy into electric one (Yu.M. Goriachev), hexagonal boron nitride, which became the basis for the synthesis of superhard materials (M.S. Kovalchenko), and many others. Emission properties of refractory materials and composite materials based on them were studied by V.S. Fomenko and I.O. Podcherniayeva. Also, there were carried out investigations aimed at creating materials for thick-film (B.M. Rud) and thin-film (L.A. Dvorina, A.F. Andreeva) technologies. To study processes of the formation of phases and substructures depending on the synthesis conditions and various external deformation and thermal actions (including high pressure and temperature), a laboratory of XRD analysis was created (led by I.I.Timofeeva).

G.V. Samsonov paid special attention to the behavior of refractory compounds in the homogeneity region, including the determination of characteristic temperatures, static and dynamic displacements of atoms in the sublattices of metals and nonmetals, nature of defects, and so on. Moreover, he founded in the department the first in the AS of Ukraine laboratory for protective coatings (A.P. Epik, A.L. Borisova), aimed at not only elaborating optimal conditions for deposition of high-quality coatings, but also at thoroughly investigating their properties, such as fire, wear, and corrosion resistances, depending on the production conditions, phase composition, and structure.

The establishment of correlation between the properties of materials and their electronic structure was a major point in Samsonov's scientific work. He developed a sound quasi-chemical approach to the analysis and forecast of material properties on the basis of the electronic structure of the atoms forming the material. The proposed by him configuration model of matter on the basis of concepts on configuration localization of valence electrons and stability of the electron configurations, which later was elaborated by L.F. Priadko and I.F. Priadko, has played a significant role in creating numerous new refractory compounds with forecasted properties. Besides, the team led by Yu.M. Goriachev performed calculations of the energy spectrum for a large series of compounds using the GOLCAO (group orbitals as linear combination of atom orbitals) method.

Many years have passed since G.V. Samsonov's decease. Much has changed, but the principal traditions of the department are kept. The electronic structure of compounds remains the major department trend. Today it is considered in terms of the first-principle molecular dynamics (V.I. Ivashchenko). For the first time, the interfaces in the heterostructures TiN/SiN, TiN/SiC, and NbN/SiN have been studied at temperatures above Kelvin's zero along with their evolution depending on temperature.

Another trend of today's theoretical studies using first-principle methods is associated with the modeling and prediction of properties for nanocomposite coating components, namely SiNx, SiC, SiCN, BN, BC_x, BNC, *etc*., under the extreme conditions which are hard to realize experimentally. Also, mechanisms of structural phase transitions in transition metal compounds (TiN, Ti_2N, VN, NbN, TiC, ZrC, and ZrN) and their solid solutions under the action of high pressure, deformation, and temperature have been suggested on the basis of calculation of the electron and phonon structures; and their elastic properties have been determined.

As ceramic components in nanocomposites are amorphous, the mechanisms of the formation of an amorphous structure were proposed with underlining the importance of the precursor structure in the formation of an amorphous matrix.

Efficient studies are carried out on obtaining and examining superhard nanostructured coatings deposited by magnetron sputtering of targets from refractory compounds of transition metals using a specially designed apparatus for dual magnetron sputtering (V.I. Ivashchenko, L.A. Ivashchenko). The obtained nanolayered and nanocomposite coatings TiN/SiN, TiN/SiC, TiN/SiNC, TiN/BCN, and NbN/SiN exhibit high tribological characteristics. In particular, the coatings TiN/SiN, TiN/SiC, and TiN/BCN have a nanohardness of 35-41 GPa, along with good tribological properties. In addition to magnetron coatings, a plasma-enhanced chemical deposition is used to obtain amorphous and nanostructured SiC and SiCN coatings characterized by high mechanical (hardness over 25 GPa, high abrasion resistance) and semiconductor (marked photoluminescence and light sensitivity) properties, which makes them be fit to MEMS application. Also, amorphous SiC films are promising in view of application in solar elements (diameter 76 mm) and light diodes. In spite of the low efficiency of modules containing such elements, their low cost may be a decisive factor in items of practical application.

Volumetric composites are obtained by consolidating metal and ceramic materials at high pressures and temperatures. In addition to the technological work in the department, experimental and theoretical studies of the structure and properties of the obtained film and bulk materials are carried out. In particular, in order to thoroughly characterize the final structures, XRD analysis, Auger, infrared and photoelectron spectroscopy are used. Mechanical properties are determined using nanoindentation, scratch and ball-scanning testing. The surface of coatings and films is investigated with the aid of an atomic force microscope and an optical prophylometer. The XRD analysis made it possible to establish the mechanism of structure and phase formation in refractory compounds under high pressures and temperatures as well as the physicochemical fundamentals for application of high pressure in obtaining ceramics and nanocomposites (I.I. Timofeeva, A.I. Bykov).

For example, XRD studies revealed a significant difference in the deformation behavior of micro- and nanosized titanium nitride under high pressure and temperature, which helped obtain a nanocomposite with high mechanical characteristics. Investigation of the kinetics of phase formation in mechanochemical processes for some systems (Ti–C, Ti–B, Ti–Cr–B, and Ti–Al) showed a sequence of phase formation and peculiarities of the behavior of the formed nanosized phases under the subsequent nitriding, using for coatings, and sintering under pressure with preservation of a nanocrystalline structure.

The laboratory of XRD analysis carries out examination of coatings obtained by various methods, including electrospark, laser, and detonation, as well as of thin films obtained by magnetron, plasma and laser methods. XRD data make it possible to optimize conditions for production of high-quality films and coatings and to establish the mechanisms of their formation.

The department conducts joint researches with scientists from other home and foreign scientific institutions, in particular KPI, V.M. Bakul Institute of Superhard Materials and V.E. Lashkariov Institute of Semiconductor Physics of NAS of Ukraine (Kyiv), Lawrence Livermore National Laboratory and Brookhaven National Laboratories (USA), Technical University Munich (Germany), University of Poitiers (France), University of Ontario (Canada), and Serbian Academy of Sciences and Art (Serbia).

The scientific works of the department are published in leading home and foreign scientific journals, such as Powder Metallurgy and Metal Ceramics, Physics of Metals and Advanced Technologies, Physical Review B, J. Phys. C: Cond. Mat., Surface and Coating Technology, Applied Surface Science, Diamond and Related Materials, and others.

Among the employees of the department there are winners of the prizes of I.N. Frantsevich of NAS of Ukraine and the Tribology Society of the USA (STLE).

Since 2008, the department has organized and successfully held five international conferences on the physical materials science of refractory compounds in memory of G.V. Samsonov. The next conference, planned for May 2018, will be devoted to G.V. Samsonov's birth's centenary.

By Academician V.V. Skorokhod's words, "Materials science and technology for obtaining refractory compounds, the lifework of the eminent scientist G.V. Samsonov, remain cornerstones of the scientific foundation, on which houses the Institute of Materials Science of the NAS of Ukraine."

TEACHER

HE LECTURED, TAUGHT, CHAIRED, ARRANGED, WROTE, TRAINED, EXPERIMENTED, READ, CORRECTED, EDITED, REPORTED, ORGANIZED… HE WAS SAID TO BE WORKING EVEN WHILE SLEEPING.

T.Ya. KOSOLAPOVA,
D.Ph. in Chemistry

HOW G.V. SAMSONOV TAUGHT ME

P.S. Kyslyi
Academician of the NAS of Ukraine, V. Bakul Institute for Superhard Materials of the NAS of Ukraine

I think the articles of this book fully illustrate the range of G.V. Samsonov’s studies. I would like to say a word about his great teacher's talent. As his diligent student, I will try to testify to it basing on my own experience of mastering scientific wisdom under his direct supervision.

After finishing KPI studies in 1957, I was appointed to IPMS and had a talk with Grigorii Valrntinovich. He questioned me about my knowledge in the field of powder metallurgy and refractory compounds. I bravely replied, "I know that carbides and nitrides are contained in steels."

"Your knowledge of refractory compounds is just colossal! But I’ll take you. Judging by your grades, you are diligent."

"Unfortunately, I do not have a Kyiv residence permission."

"Never mind! They will give it to you."

I wrote a letter to Kyiv's passport office requesting that I be registered in Kyiv, for IPMS will not be able to fruitfully work without me. The head of the passport office was very suprized at my insolent words but finally wrote a resolution to register me.

G.V. Samsonov permanently controlled the work of each employee, discussed in detail the results obtained by him. On Fridays his graduates "shook" in front of his office. To come to him without expected results meant to get a bitter portion of "Samsonov’s criticism". He constantly demanded that employees monitor new journals and regularly publish new scientific results.

Relations among young researchers at the Institute were creative. All of the departments possessed a pretty poor equipment, but we all helped each other. For example, we frequently conducted examination of scale resistance at night. I was engaged in the development of extrusion forming of refractory compounds, which permitted obtaining relatively long blanks for jackets, pipes, thermocouples, and rods using specially designed molds. I remember Samsonov once asked, "What kind of plasticizer do you use?"

"Mother-in-law’s starch."

"Take her as a co-author".

Another direction of my research was sintering. We developed various materials and products from them to be used in military engineering and in the national economy as a whole, in particular:

• protective jackets on the basis of silicon carbide for thermocouples used in measurement of high temperatures in oxidizing media and cryolite-alumina melts and zirconium diboride based jackets for permanent control over temperature of melted steel in open-hearth furnaces, *etc.*;

• high temperature thermocouples for temperature mesurement in aggressive gas media and vacuum (C/TiC) and in oxidizing media ($MoSi_2/WSi_2$);

• high temperature heaters from molybdenum disilicide for furnaces with oxidizing media and operation temperatures up to 1600 °C;

• refractory materials for various areas of the national economy and military industry, such as plates of cutting tools for processing steel, metals, and nonmetals (wood, graphite); crucibles-heaters for evaporation of aluminum in vacuum; wire cutters; nozzles for spraying pulp and sand in sandblasting machines; parts of gas turbines; substrates for integrated circuits; cell structures of catalyst carriers for chemical and automobile industries; grinding balls for mills; parts of shut valves of oil wells; armored ceramic plates for bulletprof vests, *etc.*

G.V. Samsonov treated young scientists with great care. Once, I was charged with writing a review for someone's dissertation summary. I spent on this job three hours, did it, and said in conclusion, "The work is poor; I had to write a negative review". Samsonov replied, "This work has been done for three years, and you killed it for three hours. Keep in mind forever that a negative comment should be given only if you can prove that the work does not correspond to the level of current science or is of no practical significance. Negative points are present, to varying degree, in every work, in yours as well. Moreover, you do not offer anything but only criticize. Of course, it is necessary to criticize, but, at least, to formulate phrases with respect like this, "I consider it to be wrong, because...". If you say simply "wrong" without explanation, it is not criticism, but bragging." From then on I always followed this principle.

G.V. Samsonov was not a great Ukraine fan. He once asked me, "Do you purposefully speak only Ukrainian to your fellow-workers?"

"Why purposefully? We are all Ukrainians. And Taras Shevchenko wrote,

> Don't make a fool of yourself,
> Instead – study and read books,
> Get to know foreign things
> Not avoiding yours.

We have Shevchenko, the greatest authority. Have you ever read "Kobzar" by Shevchenko?"

A week later Grigorii Valentinovich noticed, "Your Shevchenko, truly, is a mountain, but very gloomy."

"Of course, how you could be merry when

> I am captured day and night
> And forgot the care.

Oh my God, somehow hard
All my days are carried".

Samsonov was not a possessed communist. In the 1960th, the Club of Creative Youth appeared in Kyiv. There, in 1962, a party in memory of the great Ukrainian stage director Les Kurbas, killed on Solovki, was organized. To get to the party, everyone had to pass by numerous photoreporters. As a result of their work, three days later Samsonov said, "Do not joke! Before going to memorize those killed, remember that in our State Emblem there is a hammer on the left – it strikes not weakly, and a sickle on the right – an old inventory, but it cuts, anyway."

Right away I described our emblem in a poetic form:

To the right you see a sickle,
To the left you see a hammer.
That is famous Soviet Emblem.
If it does not take your soul,
It will cut or beat you down.

In 1964 after the fire in the building of the National Library of Ukraine, I said a couple of hard words at the Institute's Communist party office. Immediately the chief called me up.

"Why do you permit yourself to speak in such a way at the party committee? Why are you and your fellow-workers so expressive?"

"My fellow-workers are decent."

"Are all of them decent?! There are thirty people in your laboratory, so there are at least two-three "seksots" (so-called secret KGB agents). Maybe, you have not yet realized where you live. Hold your tongue behind your teeth."

In 1965, Samsonov sent me to Romania for thirty days instead of himself "What shall I do there?" I asked.

"Nothing especial. You'll see what's going on there. You should be known abroad. There many interesting scientific conferences are held, you may make reports at them. One else point: without visiting socialist countries you will not be allowed to visit capital ones."

It was a business trip by the program previously designed for G.V. Samsonov. Accordingly, various meetings were held with the ministers of education, metallurgy, then with leading experts at the University of Bucharest, at the nuclear reactor plant, and finally at the Semiconductor Plant founded by a French company. Every evening I was taken to the theater, circus, or a concert. I was even taken to the international mountain resort in Brasov, even shown the Royal Palace!

Coming back, I wrote a report on this "business" trip, including the visit to the Semiconductor Plant and exluding the most interesting and pleasant moments. The following year, I met the chief engineer of the Semiconductor Plant. He said, "I was fired from work for your visit to the plant. Nobody should have known about your visit. Well, don't worry. I am currently working at the university. It is a more interesting job. I feel like a free man."

I told Samsonov everything. He cautioned, "Keep in mind for the future: write in reports only what was supposed to be seen by the program, otherwise you will not be shown anything interesting at all. The Semiconductor Plant was not mentioned in that program, since it was "closed" for similar visits."

In 1977, I went to the International Congress on Powder Metallurgy in Austria. As a Samsonov's former student, I was met by Professor Kieffer and introduced to his Austrian colleagues and other scientists from Germany, France, the USA as well as to Schwarzkopf's family (the owner of the Planseewerke company), who invited me for lunch together with Kieffer. Members of our delegation were surprised, "Why are they all so careful about you?"

"Because Kieffer and Samsonov are close colleagues. They worked together after World War II, when Samsonov served as a fellow of the occupation commission under Marshal Koniev's direction. And I am his former student. This is the only reason."

Thanks to the warm Kieffer's care, at all subsequent international meetings, I aquired a lot of acquaintances and friends. I participated in international conferences on powder metallurgy, sintering theory, theory of solids and ceramics, *etc*. And most importantly, I felt free, since during any discussion I could be supported by any of Samsonov's friends.

G.V. Samsonov demanded that all the obtained findings be published. It was necessary that other researchers also know the news and "do not dig in spots where there is nothing to be digged out". One of our joint works was immediately published by the International Plansee Society for Powder Metallurgy under the rubric "The best works on powder metallurgy". Most of my articles, before the defense of my candidate dissertation, were published in co-authorship with G.V.Samsonov, but after the defense he said, "From now on you have your own scientific career. Publish articles by yourself."

Samsonov corrected my doctoral dissertation twice. On the eve of its defense I saw a dream with devils, got upset, and told Samsonov about the dream. He calmed me down, "There are devils everywhere except our scientific board. Don't worry."

In 1974, Grigorii Valentinovich felt sick and stayed long in the hospital. His disease was serious. In November, he came to the Institute for one day, invited me to his office and said, "Well, we have worked very well. Tomorrow I'll be taken to the hospital again. Maybe, I'll leave it, maybe, I'll stay there. I ask you to be careful. Soon there will be no one to protect you. Continue investigating refractory compounds..."

He did not come back from the hospital. It was a shock: as if you were in the rear and at once got to the front line. There happened to be no one to ask for help and advice. At the sector, all of us, his associates, continued to hold together but like waiting for a storm. The work became hard and uncomfortable. A short time later, I moved to the Institute for Superhard Materials of NAS of Ukraine.

A year later, "samsonovtsy" decided to put a monument on Samsonov's grave; collected required money, bought a granite block, and brought it to the territory of the cemetery so that the sculptor could carve a monument there. Shortly the block was stolen. Then I went to our director Academician N.V. Novikov and talked about that situation. He said, "We will buy another stone at the granite factory for the Institute, bring it to your territory, and let your sculptor carve out his sculptures." Two months later, the monument was made.

A more important material monument to Grigorii Valentinovich is the following plants: Kirovakansk Factory of High Temperature Heaters, Svetlovodsk Plant of Non-Ferrous Metals; Workshops at Brovary Powder Metallurgy Plant, Tashkent Abrasive Plant, and Donetsk Plant of Chemicals.

The most important, spiritual, monument to Grigorii Valentinovich is his numerous published works and numerous disciples brought up for his beloved science.

Grigorii Valentinovich Samsonov left life young and remains young in my memory.

AN EMINENT MAN AND LEADER

V.S. Neshpor
Candidate of Engineering Sciences, Russian Research Center "Applied Chemistry"

Rare metals and superhard refractory compounds, logical conceptions for making new classes of materials with prognostical properties, high-efficiency cutting and abrasive materials and superconductors, new approaches to the complex problems of physics of materials and technology – all these scientific and practical matters are closely related to the name of the great scientist Grigorii Valentinovich Samsonov.

The beginning of the industrial manufacture of refractory compounds and materials based on them is also related to this name. The plead of Samsonov's disciples and followers is big. All of them developed, under his attentive and always well-meant supervision, new concepts of investigation into the properties, technology, and application of inorganic materials. Today they cherish his ideas and concepts of science, practice, and the spirit of his unselfish devotion to science and people, conveying all this to their disciples.

Everyone who communicated with Samsonov, or mere met him at some scientific seminars and symposiums, or came to consult him, or asked for advice – remains linked to his image forever. In spite of his complicated administrative duties (he was a talented organizer of the work of numerous scientific and manufacturing associations), he was primarily engaged in scientific activity and had time to listen to everyone's problems, no matter an Academician or a young student was before him. A great deal of people wanted to visit Samsonov's office to report something, to exchange scientific ideas or doubts with him, or to ask for advice or help while organizing their researches or having some personal problems. The writing desks in his administrative offices and at home were always overcrowded with a great number of letters, official and unofficial, which contained numerous suggestions, scientific articles, petitions, and sometimes most fantastic projects and ideas. But none of these letters was left without a reply until his last days of life.

The working ability of Samsonov was phenomenal. When there was not enough time for all of the problems to be discussed in his offices, he asked his colleagues, students, or collaborators to his place in the evening. Late at night he used to say, "Well, nothing can be done, we have to part now. I still have a lot of work to do." And long after that the light in the window of his study could be seen, clearly distinguished against the dark facades of sleeping apartments.

Samsonov hated passive relaxation. During summer vacations he rented a cottage in a picturesque town, which became a headquarter for an army of scientists, predominantly young people, whom he loved and who were truly devoted to him as well. He lived alone there, or better to say, he preferred to stay alone, so as to write without any disturbance.

Very modest in everyday life, Samsonov did not like to waste time on getting material benefits for himself as well as doing formal things in order to get some higher position or rank. Giving all his being to work, he was indifferent to the material things that marked personal prosperity.

Very strict to himself and his associates concerning work duties, he was very attentive to their personal problems and needs, deeply sympathizing with them. I rememder a typical case. One of his employees was on a long official trip. Suddenly he was informed about serious disease of his mother, who lived in Moscow. Out of himself he called Samsonov for permission to leave his work and go to see his mother. First of all, Samsonov advised him to compose himself and hope for the better. Then told him to go to Moscow immediately. Two hours later an express cable came with an order to continue the business trip in Moscow. Moreover, a cheque came from Samsonov: he guessed that the young man did not have enough money for his needs on him.

He had a wonderful talent to find the right thing a person should do, to find out whether he could be, according to his abilities, fruitfully engaged in theory, or experiment, or organization, or manufacture matters. Then, with this in mind, he assigned him to do proper work and at an institution where he had all advantages to be most useful for society.

Samsonov was a very social person. He was sure that positive competition of scientific schools, ideas and trends, as well as firmly established contacts among researchers from various institutions and their formal or warm friendship offer great advantages to the development of science and accelerate the rate of researches. He made great effort and spent much time organizing scientific workshops, conferences, and symposiums, trying not to limit, if possible, the number of expected participants but, quite the contrary, to enable both known and young scientists to take part in them. He himself gladly accepted invitations to make a report at various institutions and conferences both in the USRR and abroad. He believed that live information, the opportunity to jointly create new ideas, and fresh official and private impressions were a mighty stimulus to the science-engineering progress, and that time and money spent on the gatherings of scientists would be repaid very well.

One of the characteristic traits of Samsonov and his school was a non-standard and non-scheme approach to the solution of fundamental problems. He never approved references to recognized authorities, including his own, when one had to confirm some scientific conceptions. On the contrary, he often insisted (and taught us to do like that) on starting from the given material and strict logic while forming theoretical models of the material structure or finding out technological solutions. Many of his ideas were not easily accepted. A number of scientists recognized them only a long time later. Nevertheless, the very discussion on these ideas was a stimulus to new researches, new models, and concepts.

In his letters, he frequently wrote about the progress and achievements of his disciples with proud and sincere joy, or was sympathizing with them in the case of failure.

Up to the last day of his life, he worked hard and, although he was aware of his health condition, wrote letters to his disciples full of encouragement, advising them to take part in research activity, and ended the letters with the words, "Never mind, we will cooperate for a long time."

Such a man lived in the world, a knight and a poet of science, a great, mighty, and good man, and as such he will live forever in our memories.

THE SCIENTIST-TITAN

B.M. Rud

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I was lucky: after graduating from KPI in 1963, I got to work not only at the prestigious research institute IPMS, but also in the sector headed by the well-known scientist Grigorii Valentinovich Samsonov. At the beginning of our first conversation he seemed to me cold and detached but soon his severity dissapeared, and it was great pleasure to talk with him.

His appearance reflected his deep inner world. A broad outlook, encyclopedic knowledge, extraordinary working ability, and systematic hard work were the tools which Grigorii Valentinovich had made to attain great achievements in science.

Nobody pushed him up a carrier ladder, and he never had high-ranking patrons or promoters. He made himself and achieved everything thanks to his hard work and talent. As it is often the case, the character of extraordinary people is not angelic. Grigorii Valentinovich was a man of autocrat character, he never cringed before anyone, sometimes he was violent and straightforward, especially in matters of principle, harsh and inaccessible, but in a hard moment he always supported colleagues, students, and acquaintances, and never left them alone with their problems.

I cannot forget the fact happened to me in 1968. The government issued a decree, according to which all reserve officers under the age of 28 were to serve in the Soviet Army for two years. I just arranged my candidate dissertation, published the summary; the official opponents had been invited to the defense time on October 15. I came to the district military office, where I was ordered to serve as a lieutenant in the Trans-Baikal military district for two years from the early September. I made my way to the district military commander, showed him the dissertation and the summary, and was given a two-month delay with the words, "You must defend your Motherland, not your dissertation!" I began preparing for the army. But our Institute soon received permissions for Army service retention for some IPMS employees, and Grigorii Valentinovich included me on that list. I was amazed at this act, for I had not asked him for anything. I am sure that many of our co-workers could give similar examples.

Grigorii Valentinovich was a real workaholic. It seems to me that the most important thing in life for him was work, even not a family, not to mention leisure or amusements. He constantly discussed scientific and business problems with somebody in his huge office; under his leadership, scientific seminars, workshops, and defenses of dissertations were held. His working day began not later than at 8 : 00 AM (at the Institute it began at 9 : 15) and lasted no less than ten hours plus he worked at home for several hours.

I cannot recall such a year when Grigorii Valentinovich used his vacation for a rest. He spent it either in his office or at the desk in a summer cottage, which he rented near Kyiv. There came to him a staff member, brought and the following morning took off necessary correspondence. The leadership of the sector and the connection with the Institute administration did not cease either. He devoted most of his weekends to writing monographs and articles. But at the same time, he found time to read the fiction, of which he was a great connoisseur.

Grigorii Valentinovich regularly looked through scientific periodicals. He spent a quarter of his salary on the subscription to a large number of scientific journals and systematically reviewed them closely.

As a sector leader, Grigorii Valentinovich devoted much attention to investigation of the physical properties of refractory compounds. Under his leadership more than 500 carbides, borides, nitrides, germanids, chalcogenides, and other refractory compounds were synthesized predominantly in a powder form. About 70 methods for obtaining compact samples from them were developed in order to make required articles and investigate their properties, including physical ones. The following tasks were put:

- to get primary information about the physical properties of synthesized compounds;
- basing on it, to clarify the electronic structure and the nature of the chemical bonding;
- to search for practical use of the obtained refractory compounds in various fields of current technology.

Furthermore, taking into account the lack of modern equipment, G.V. Samsonov organized work on design, construction, and improvement of needed installation. There was a rule, a kind of tradition, for a long time: first of all, each young specialist and almost each graduate student had to create an installation or an experimental method.

Most of the synthesized refractory compounds were subjected to a comprehensive physical examination. A huge base of experimental data on the physical properties of practically all classes of refractory compounds was accumulated. They were systematized by G.V. Samsonov himself, his colleagues, and followers in the reference books and numerous monographs, which at the present still remain of great encyclopedic value.

Experts in materials science know well these publications — reference books on the properties of elements and refractory compounds, monographs on borides, carbides, silicides, nitrides, germanides, as well as on compounds of transition and rare earth metals. Many of them were translated into foreign languages and published abroad.

An important milestone in the scientific work of Grigorii Valentinovich, his favorite brainchild, was the configuration model of matter, which the scientific world treated in different ways. I remember the emotions of adherents and critics of this model that often flared up at various scientific gatherings. Now, after five decades, I will try to briefly formulate my opinion about the model. It was based on the concepts of configurational localization of valence electrons and the stability of electron configurations. Despite the fact that this model was not sufficiently formalized and supported by quantum mechanics calculations, it played a big positive role in the science of refractory compounds. It was developed on the basis of the correlation of the electronic structure of atoms with the real properties of alloys and chemical compounds. It did not claim for perfection, but contributed much to predicting the properties of new materials and creating materials with required properties. Thanks to its simplicity and accessibility, the model helped many physicists, chemists, technologists, and even doctors to solve materials science problems.

Grigorii Valentinovich left a huge literary heritage concerning refractory compounds, more than 1000 publications. He was truly a scientist-titan!

Moreover, he founded a scientific school, whose direction I would like to formulate as follows: research and development of the physicochemical basis for synthesis of refractory compounds, study of the regularities in the formation of their electronic structure and properties, and the creation of materials based on them with required properties. The urgency and importance of this trend are quite obvious today.

I worked under the guidance of Grigorii Valentinovich for twelve years and I greatly appreciate that I attended his scientific school and published with him a monograph, two reference books, and a number of scientific articles.

From 1992, for fifteen years, I was in charge of the Department of Physical Materials Science for Refractory Compounds, the head of which had been Grigorii Valentinovich. I became convinced that to become such a leader as Grigorii Valentinovich was, one should be born with the same capacities. It is just impossible to train them.

Grigorii Valentinovich left this world when he was 57. Today his ex-graduates, applicants for degrees, and staff members are far older. For all of us he will remain Teacher with a capital letter forever.

HOW G.V. SAMSONOV CREATED HIS SCHOOL

I.A. Podcherniayeva
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I became aquainted with Grigorii Valentinovich in May 1962. A friend of mine, who had been working with him for some years, was enthused about him, and this prompted me to go to IPMS. I clearly remember how I entered a room which was difficult to call an office: it was narrow, very long, along the walls stood tables — no attribute of power and significance. It looked like a monk cell.

At one of the tables was sitting a heavily-built, middle-aged, handsome man with a cigar in his hand. It was legendary Samsonov. His appearance, look, and manner of speaking expressed energy, activity, intelligence, and purposefulness. He was interested in my background in physics and metallurgy. The result of our talk was my enrollment in the staff of IPMS to work under his direction.

Some months later, at one of the scientific seminars, Samsonov said words which are memorable for me forever. It was an appeal to us (participants of the seminar were predominantly young people as-graduated from higher institutions) to go on studying at work and to be fully engaged in science through preparing dissertations. He said, "Pots are not made by gods, you must only work twenty four hours a day!" He himself always followed this rule. I have not met a person who could be so absolutely devoted to science, be in love with science, and it was sincerely (not for a show!). He indeed charged us with his "scientific romance". We worked inspirationally, "not looking at the watch", and, when it was necessary to conduct a technological process running stoplessly a whole day, we did it, and that was considered normal, as Grigorii Valentinovich was an example of industriousness for us.

Grigorii Valentinovich loved young people, he was engaged in a great deal of systematic work with graduates. In the year of my admission to the graduate school (1964), he had thirty graduate students! In parallel, he headed the sector, which included eight departments, was Deputy Director of IPMS, and chaired the KPI Department of High Temperature Materials and Powder Metallurgy, which he founded. With such a colossal pressure of work, he devoted himself to graduate students every Friday. His consultations began at 8 : 00 AM and lasted till the end of the day. God forbid miss the appointed time! And not because we were afraid of him, but because we were very respected and loved by him and tried to meet his expectations. As a rule, the work at a dissertation lasted three years, and I remember the only case the defense failed. He lost interest in a person when he saw his lack of interest in research.

I recall a typical case. At a scientific seminar, a young specialist from a small Azerbaijan town was to make a report on his candidate dissertation. Grigorii Valentinovich happened to urgently have left for Moscow. The young audience immediately noticed all the shortcomings of the dissertation and made a negative verdict. Coming back, Grigorii Valentinovich reacted negatively to that decision. He said, "Scholars from province are often deprived of the good that we always have in our capital, so we should not "drown" them, but help with advice."

Five years after, already in a respectable Grigorii Valentinovich's office, a meeting of the Section of Refractory Compounds at the Scientific Council of the Institute took place. The participants were the same young people. Again, a new call was addressed to us, "Prepare and defend doctoral dissertations. I am not afraid of competition!" I can testify that at least 70 % of his students subsequently became doctors. In such a way Samsonov "tempered" his followers.

Grigorii Valentinovich was a great bibliophile. In Kyiv he was one of the largest subscribers to all kinds of literature, not only scientific. The graduate room (created on his initiative) was equipped with book shelves full of scientific and educational literature from his home library. He demanded that we, young specialists, keep track of all information on special issues in foreign and domestic scientific journals. Moreover, regularly, in the morning each of us found a card on his desk with references to scientific sources on the specific issue, on which the addressee was then working.

Grigorii Valentinovich not only loved to work, but also knew how to arrange a nice brief break. My favorite holiday was Woman's Day, on March 8. Traditionally, that day each woman of our department, entering her lab, noticed a bouquet of violets and a card with witty wishes, sometimes rhymed. At lunch time, the table in the graduate's room was set with a samovar, champagne, cakes, and candies. Exactly at 12 : 00, Grigorii Valentinovich came in and spoke a toast, always very ingenious and never repeated. Generally, he was a very interesting interlocutor, strucking by his colossal erudition and a high level of culture.

As a scientist, Grigorii Valentinovich was a possessed man. He boldly developed and used nonconventional approaches to the treatment of physicomechanical and physicochemical phenomena within the framework of his concept on connection of various properties of substances with the peculiarities of interatomic interactions, including phenomena on the surface, in particular thermoemission and adsorption. In contrast to the traditional views, he considered and promoted his revolutionary ideas at forums, conferences, and workshops of different levels. In the field of materials science of refractory compounds he enjoyed tremendous authority among both domestic and foreign experts. He was a member of many reputable international scientific communities. However, as they say, there is no prophet in his homeland: the innovative ideas of Grigorii Valentinovich met the greatest resistance just in the homeland.

Grigorii Valentinovich showed up great fighter traits when he defended his scientific ideas and taught his students to do like that. He did not train us inside the office only, but "threw" us onto the arena of international and all-Union conferences with very controversial messages. And we, confident in our Master's rightness, with boldness entered into battles, and often successfully. I remember my speech at the All-Union Conference on Emission Electronics in 1969 in Moscow. The chairman was Academician L.N. Dobretsov, one of the world leaders in the field of electronics. At the end of the discussion on my report, he took the floor, "Sometimes I am accused of being a creature eating young scientists. But you can see that I have not eaten up this girl and even liked her ideas."

I do not aim at highlighting Grigorii Valentinovich's scientific or administrative activities, I would like to emphasize the way he "tempered steel", i. e., formed a school of young scientists. He managed to do this like much of what he did, that is, successfully. His early death broke his plans, but the students continued his work in many scientific fields. For example, he planned to create an institution for protective coatings, and then that seemed unreal. However, over the following twenty years, the interest of researchers and engineers in this problem steadily increased, with special attention being paid to the creation of high-temperature wear- and corrosion-resistant coatings based on refractory compounds. Former students of Grigorii Valentinovich have founded the Institute of Materials Science of the Far East Branch of the Russian Academy of Sciences (A.D. Verkhoturov) and the department of coatings at Ye. Paton Institute for Electric Welding of NAS of Ukraine (A.L. Borisova, Yu.S. Borisov). The direction of coatings is intensely developed at the Institute of Chemical Physics of NASU (A.V. Paustovskii, Yu.G. Tkachenko, I.A. Podcherniayeva, and A.D. Panasiuk).

Under G.V. Samsonov's supervision more than 15 doctoral and 200 candidate dissertations were defended.

Grigorii Valentinovich Samsonov was one of those who expand the Path for the going.

SCIENTIFIC TEAM AND ITS LEADER

I.I. Timofeyeva
Candidate of Engineering Sciences,
IPMS of the NAS of Ukraine

I distinctly recall the International Carbide Conference held in 1964. After my seven-year work at an industrial plant, the reports that I heard there seemed to me as real messages from megascience. The chief generator and concentrator of ideas was Grigorii Valentinovich Samsonov, active, energetic, friendly, and deeply interested in all the details of the problems and phenomena under discussion.

To me, he seemed to be an inhabitant of the heavens. Therefore when, a year later, he offered me to try to join his graduate course, I was beyond myself with excitement, fear, and joy.

On starting work at my dissertation, I realized that I got into a scientific team, whose work was closely supervised by Samsonov. The team was friendly. It was united with the community of carried out investigations and good human relations. The complexity of the research required the unification of efforts of various specialists and by various ways. Progress was only possible in the benevolent creative atmosphere created by our scientific leader. The work of such a large scientific team (about 300 employees) was focused on the development of technologies for the production of refractory compound powders and fabrication of various articles and coatings from them. Numerous physical, physicochemical, and mechanical properties were studied.

I investigated the peculiarities of the structure of compounds depending on the production conditions, composition, and properties. The general task was to create novel promising materials, and a key ideology was the dependence of the material properties not only on the production conditions, but also on the electronic structure. In addition, it was necessary to investigate the behavior of the obtained materials under the service conditions.

Despite a big number of graduates (thirty), Grigorii Valentinovich was very attentive and demanding to each of us and, at the same time, relentlessly concerned with our findings. One day a week was a graduate day. That day, each student was to discuss with him everything that had been done for the previous week and to get advice and valuable instructions for the following week. When the task was not fulfilled – oh, horror! – he got very strict, even angry, when he saw that somebody had not been working hard enough. Nevertheless, at the reclassification of graduate students, Grigorii Valentinovich found for each one special good words testifying to how clearly he saw the individuality of everyone. How high he appreciated everything that someone had managed to do for science! Of course, this gave a strong impetus and even winds to young people.

I was appointed Chair of the Graduate's Board of the Institute. On the initiative of Samsonov, we organized the first Institute graduate conference. He also invited the leading experts of the Institute to participate in the conference. It was a real graduate school, which taught us to defend our findings and views at future international conferences.

Sorry to say, graduate training is temporary. It took three or four years, then graduates defended their dissertations and continued to be enthusiastic about science. Many stayed at the institute (it was years of flourishing materials science at IPMS); some went to work in other organizations, but never broke scientific contacts with G.V. Samsonov. All students, employees, and colleagues were under the influence of his mighty creative potential. He was a scientist with a unique combination of such amazing qualities as the talent of a researcher and an engineer, the gift of an organizer and a teacher alongside with high morals of a man whose love for people was combined with passionate love for science — high words, but they are true.

Grigorii Valentinovich was at the forefront of science, when he conducted numerous comprehensive studies of the conditions for synthesis of almost all classes of refractory compounds — borides, carbides, nitrides, silicides, hydrides, phosphides, aluminides of transition and nontransition metals as well as carbides and nitrides of boron, aluminum, silicon, in short "samsonides" (as so lovingly these compounds were called). Those fundamental studies helped reveal the physicochemical foundations of the refractory compound formation.

The obtained compounds were thoroughly investigated in a wide range of temperatures and compositions, especially in the homogeneity regions. As a result, it was shown that the change in the nonmetal content in the homogeneity region of carbides and nitrides of transition metals manifested itself by the change in the total bonding in the phases, which is different for compounds of transition metals of different groups of the periodic table of elements. This involves difference in most of their properties. The studies allowed a deeper penetration into the nature of the phases and the laws that form their properties.

The synthesis of compounds was always followed by a thourous investigation of their properties and a detailed examination of the crystalline structure. Grigorii Valentinovich considered knowledge of the regularities of the crystalline structure formation to be important both from theoretical and practical viewpoints. The former is important since the symmetry of the crystal lattice and the nature of the electronic structure of crystals are interconnected, whereas the latter is also essential since change in the type of symmetry of the crystal lattice is often accompanied by change in the complex of the physicochemical properties.

The peculiarities of crystalline structures and physicochemical nature of phases formed through different types of chemical interaction of elements, such as clathrates, solid solutions, compounds of constant and variable composition, pseudoalloys, and intermetallic compounds, were considered on the basis of the model of configurational localization of electrons in solids proposed by Samsonov and successfully developed by his graduates, I.F. Priadko and L.F. Priadko.

G.V. Samsonov supposed that the most efficient means for changing the structure and properties of known materials and creating new ones could be high pressure, the use of which may provide a substantially higher level of properties than that of materials synthesized by traditional methods. Some carbides, nitrides, borides, and also complex phases, boron carbonitride and aluminum–boron– nitrogen, were obtained using high pressures. And soon the first promising results appeared: under the action of shock waves, cubic tantalum nitride was obtained, which is a superconductor. The opportunity to obtain cubic tungsten carbide, cubic boron nitride alloyed with carbon and aluminum was shown. The synthesis of molybdenum carbides under shock waves was studied as well.

It is evident that such a huge amount of work can be carried out only by a large scientific team, united with the same views and goals. Only a scientist of a broad outlook and a high culture can create and lead such a team. These qualities were inherent for Grigorii Valentinovich. The recognition of the primacy of the electronic structure in the consideration of all material science issues became a distinctive methodological principle for the whole scientific community headed by G.V. Samsonov.

Being in correspondence with many of the world’s scientific laboratories, he received direct information on the new developments in the world science and the latest scientific publications. All this information became a common property of his students and colleagues.

Samsonov was a true teacher, mentor, and "compass" in the turbulent world of science. Each gathering of governed by him scientific councils was a school where, in the form of a benevolent but strict and principal discussion, fresh findings were considered and further paths of research were envisaged. Mighty talent, titanic workability, and an amazing feeling of innovations made Grigorii Valentinovich a "beacon" for many hundreds of researchers.

MY WORK WITH G.V. SAMSONOV

A.D. Panasiuk
Doctor of Engineering Sciences, IPMS of the NAS of Ukraine

In 1958, I graduated from the Faculty of Physics of Taras Shevchenko National University with an appointment to IPMS. I came to an interview with Professor Grigorii Valentinovich Samsonov, who had already been a well-known scholar in the field of materials science for refractory compounds. During this first rather a talk than an interview he told me with aspiration, purposefulness, and conviction about the prospects of my work in the field of developing new materials with predetermined properties and studying their physicochemical properties. His bright speech immediately conquered my mind and onclined to cooperate with such an amasing person.

Initially, I was engaged in the synthesis of disilicides of IVA-VIA subgroup transition metals. Our laboratory investigated the peculiarities of sintering of metal disilicide powders under pressure; studied their structure and physical properties, in particular electrical conductivity, thermoelectric power as well as heat resistance, mechanical characteristics (strength), and Young's modulus. A large scope of our work was related to the development of new materials for gas turbine blades in cooperation with the All-Union Institute of Aviation Materials (Moscow). We worked in two shifts, and sometimes even at night, and were proud to be engaged in such an important problem: we created novel promising materials that had not yet been obtained by anybody!

Samsonov, with all his diligence to subordinates, exceptional purposefulness, and colossal work efficiency was particularly fair, attentive, and charming toward us, young engineers and researchers.

After my being awarded a candidate degree, Grigorii Valentinovich advised me to systematically study the surface properties of refractory compounds and materials on their basis (adhesion and wetting in the related systems "refractory compound – melt"), aiming at creating new cermet materials with the required level of performance characteristics to be used in various branches of engineering. This trend became predominant in my researches for many years.

Samsonov's ideas about the development of advanced technologies for the production of refractory compounds and high-temperature composite materials of various classes as well as coatings based on them, and about interpretation of such properties as adhesion, wetting with metal melts, high-temperature oxidation, mechanical (strength) and others, have accompanied me through all my scientific life. Under the supervision of Grigorii Valentinovich I defended my doctoral dissertation.

G.V. Samsonov combined the traits of not only a responsible, all-knowing scientific leader, but also an intelligent, kind, and highly educated person.

A MAN OF LIGHT SOUL

After graduating from KPI in 1957, I was appointed to work at IPMS. There I was received by a tall and solidly built man with a handsome courageous face and smiling eyes. It was legendary Grigorii Valentinovich Samsonov. I was employed as an engineer and started my scientific activity under his guidance. In his department, then, mostly young people as-graduated from universities worked. And Grigorii Valentinovich, not sparing his time and effort, taught us how to work. He taught us to think over, analyze, discuss, and describe results obtained, to work with literature, to make reports. He made each of us review a specific scientific journal and then to report on new scientific developments at weekly department seminars.

Additionally, Grigorii Valentinovich believed that a researcher should be deeply and widely educated. Therefore, taking care of us, he was interested in the kind of fiction books we read, whether we went to the theater, and the like. He recommended us classics, advised to attend the Philharmonic. A poster with the repertoire of the Kyiv Philharmonic always hung on the lab wall. He himself was a highly educated, highly erudite, and highly spiritual person. He possessed the best qualities characterizing progressive Soviet intelligence, such as integrity, unique erudition, and profound knowledge combined with simplicity.

Many of us, young specialists, were hardly familiar with powder metallurgy, therefore Grigorii Valentinovich invited us to attend his lectures on this subject which he delivered to the students of KPI. It was a great pleasure to listen to his lectures. He was a most talented lecturer. He described the subject so clearly and exhaustively that afterwards nobody needed to look up into textbooks.

He was very strict, authoritarian, at times rigid, but, at the same time, a sensitive and caring leader. I remember he once criticized my writing. Having noticed my tears, he smiled and said, "Well, don't cry. I don't scold those I don't love, do I?"

We were to come to his office every week to report and discuss the performed experiment. And he had time for each of us.

G.M. Makarenko

Candidate of Engineering Sciences, IPMS of the NAS of Ukraine

Samsonov was remarkable for extraordinary capacity to work; he wrote a lot, lectured, instructed, arranged, corrected, edited, and so on. He usually came to work before everyone. Once I asked how much he slept, and he replied that he could not afford more than four-five hours.

Despite the external rigor, Grigorii Valentinovich was a very kind and sensitive man. In particular, he liked animals very much. Every morning, walking to work from the electric train stop, he fed stray dogs.

Having completed my dissertation, I, by Grigorii Valentinovich's advice, started developing a new method for obtaining refractory compounds, namely the plasmochemical synthesis. He was always interested in everything new and underlined that he was a scout in science. He organized in Kyiv the first All-Union scientific seminar "Plasmochemical synthesis of refractory compounds". Then analogous seminars were regularly held in other cities. Thanks to his help and support, the plasmochemical synthesis of refractory compounds began successfully developing in Dnipro, Novosibirsk, and especially in Riga, where such works are still ongoing.

Grigorii Valentinovich attached great attention to scientific-organizational work. He took part in the work of a number of scientific boards, in particular, he was Chairman of the sections of the Scientific Council on Rare and Rare-Earth Metals and of the Scientific Council on Powder Metallurgy of the State Committee on Science and Technology of the USSR (for the latter, he suggested that I be a scientific secretary). The sections coordinated and advocated the work in the field of refractory compounds. We held conferences, seminars, and other section gatherings, inviting scholars from other cities. As a result, participants of the sections became acquainted with the work of various organizations dealing with related problems. We visited research institutes of Ukraine, Russia, Georgia, Armenia, Azerbaijan, Kazakhstan, Uzbekistan, and Kyrgyzstan and established scientific links with them and thus expanded the area of research into refractory compounds.

An invaluable contribution of Grigorii Valentinovich to the development of works on refractory compounds was shown up by the first in the USSR industrial production of refractory compound powders at Donetsk Plant of Chemicals and Zaporizhzhia Abrasive Plant. At these plants, we introduced the developed technologies for obtaining more than 100 names of powder carbides, borides, nitrides, silicides, and chalcogenides. There appeared an opportunity to acquire powders in large quantities, which gave a powerful impetus to the development of works on molding, sintering, and studying physicomechanical and chemical properties of various classes of refractory compounds and thus to expand the scope of their application.

I often recall Grigorii Valentinovich Samsonov with great gratitude and I thank my destiny for meeting such an outstanding scholar, a sensitive and caring teacher, and a bright man in my life.

TEACHER AND FRIEND

V.N. Gurin

Doctor of Engineering Sciences, Ioffe Physical-Technical Institute of RAS

I first met Grigorii Valentinovich in 1960 at the All-Union Conference on Refractory Compounds. At once I liked his humanity, some kind of warmth, immediacy, and simplicity. Perhaps then a certain spark ran between us, which warmed our relations during many subsequent years.

Grigorii Valentinovich was a passionate and responsible both person and scientist. And these traits, along with human charm, attracted many and many dozens of researchers and helped engage them in studies of refractory compounds. I am happy that such fascination did not pass me.

In addition to personal encounters (at least twice a year) at various official meetings, we kept periodic and sometimes even intense correspondence, which dealt mainly with scientific and scientific-organizational problems. I still have twenty seven letters from Grigorii Valentinovich. And the first thing that attracts attention while reading them is an extremely respectful and benevolent attitude toward the addressee. There is no slightest superiority of a great scientist to an immature reasoning of a young researcher. This educative attitude testifies that Grigorii Valentinovich, in addition to his other high qualities, was a sensitive person and a subtle psychologist.

Among the surviving letters, the first one (by date) had five pages, where Grigorii Valentinovich answered my questions concerning the configuration model of matter in detail and honestly. It should be emphasized that the idea of stable electron configurations, proposed by Samsonov, was directed toward creating refractory compounds with extreme properties, such as high melting point, refractoriness, fire and heat resistance, *etc*. In a pure form, it is only applicable to the isolated state of atoms and ions. However, the formation of a solid body, whose atom electrons form stable configurations, in some way, differ from that in the absence of such configurations. Grigorii Valentinovich believed in this model passionately, which stimulated its evolution to important theoretical works of theorists I.F. Priadko and L.F. Priadko as well as to numerous achievements of material technologists, T.Ya. Kosolapova, G.N. Makarenko, V.S. Sinelnikova, T.I. Serebriakova, L.A. Dvorina, I.I. Timofeeva, V.A. Neronov, *et al*. By Grigorii Valentinovich's advice, I also dealt with stable electron configurations, but only regarding isolated states of atoms and ions.

Periodical gatherings of sections of various scientific councils of the State Committee for Science and Engineering under the Council of Ministers of the USSR were of great importance for intensification of scientific research owing to the coordination of works, communication of scientists, and a broad exchange of views. Up to 1975, the section headed by Grigorii Valentinovich, "High temperature materials containing rare metals" of the Scientific Council "Application of rare metals in the national economy" was the most active and fruitful.

The permanent academic secretary of the section, G.N. Makarenko, did a lot for organization and successful work of the section. Grigorii Valentinovich appointed me her deputy. We tried to maintain systematic contacts among the section members. By the instructions of Grigorii Valentinovich, we coordinated works on rare metals and refractory compounds throughout the country. This led to involving new members to the section with their own themes and ideas.

The section sessions took place in various cities of the USSR, including Saint-Petersburg, which Grigorii Valentinovich loved very much and tried to visit it at any opportunity. After the sessions or all-Union scientific conferences held in Kyiv, non-resident participants, as a rule, gathered at T.Ya. Kosolapova's or G.N. Makarenko's place, where discussions were ongoing even more unconstrainedly and hotly.

Grigorii Valentinovich did not like show-offs, pompous speeches, and various VIPs. Once I decided to arrange his acquaintance with our Deputy Director Dr. V.R. Regel (Ioffe Physical-Technical Institute of RAS), who began studying composites, and I thought that a refractory component in such materials would not hurt them. But Samsonov was not very glad of this idea. (By the way, V.R. Regel had the same views on his superiors).

Very rarely, Grigorii Valentinovich asked me for a favor. I did my best to please him and was very glad when he asked me to find a book about Kibalchich, who was an ancestor of his wife, Nadezhda Aleksandrovna. Of course, I found the book.

Sorry to say, in 1975 I learned about the disease of my beloved colleague. At once I went to Kyiv and happened to be the last non-resident visitor to Grigorii Valentinovich. The doctors permitted only twenty minutes for the visit, but we talked for over an hour, discussed all the problems concerning the section, our cooperation, and further scientific plans. I first heard Grigorii Valentinovich complaining about his condition, and the words "I feel sick" shocked me. He asked me to send something interesting to read (coming back to Saint-Petersburg, I immediately sent him a rare collection of psychological fiction, which he liked very much). After visiting the hospital, we (the doctor, I.F. Priadko, and me) gathered in the evening at G.H. Makarenko's place and talked for a long time about possible ways of helping Grigorii Valentinovich. We tortured the doctor with our proposals, about which he said that they were at the level of top specialists. But nonetheless, he summed up that there was nothing to be done to avoid the worst.

Sometimes I recall my first visit to Grigorii Valentinovich's place on Volodymyrska Street in 1972 right after the conference "Configurational Localization of Electrons in a Solid Body". Ya. I. Dutchak, a professor from Lviv University, dragged us (I.F. Priadko and me) to Samsonov's apartment. We were happy to talk about everything, drank delicious Czech "slyvianka". Ten years later, in 1976, Academician P.S. Kyslyi brought us there. Nadezhda Aleksandrovna warmly received us, treated with tea, gave us badges about Kyiv. We recollected the past, talked on this and that...

After the death of Grigorii Valentinovich, Kyiv became empty and indifferent for me. I have been to Kyiv many times, defended there my doctorate. But the past cannot be returned... Grigorii Valentinovich remained for me as an indispensable teacher and friend, the source of great and new ideas and inexhaustible initiative, who heard "the call of the future".

Below is the last Samsonov's letter to me from 18.10.1975.

"*Dear friend Vladimir Nikolayevich,*

Thank you for the letter from 06.10.75 and draft project of the section work. I am a liitle unwell and got to the hospital where I've already been staying for three weeks, but I hope to get out in one-two weeks.

The situation around the section is hard. It has been working at the Council too well and so provoked irritation among some important members of the Council, especially of the full-day secretary, an employee of GNTK, whom our section charges with work, but he does not want to work...

In the meantime, we'll attach the section of refractory compounds to the Council of powder metallurgy, but the themes there are different – techniques and theory for pressing and sintering. That is way the section may become as follows:

Head G.V. Samsonov

Deputy Head on physicochemical problems V.N. Gurin

Academic Secretary G.N. Makarenko

Deputy Head on technology P.S.Kyslyi

Academic Secretary L.I. Struk

Subsections: 1. On plasmochemistry Head Miller

2. On rare-earth metal compounds Head Lopato.

These subsections are under your supervision.

What do you think of all this? I am looking forward to your letter with your opinion and proposals...

Surely, I won't come to Piter because of the hospital. Yet, I do not waste time correcting manuscripts, dissertations, articles, etc. Nikolai has taken tender care of me, frequently visits me, sympathises with me, and provides with work to do.

The weather is awful, I am fed up with the hospital, the mood is far from heavens.

I have to mobilize all my optimism.

Best wishes,

Yours (signature)."

Дорогой друг Владимир Николаевич!

Спасибо за письмо от 6.IX.[illegible] и проект плана работы секции.

К сожалению, я подболел и попал в больницу, где пребываю уже третью неделю, надеюсь через неделю-две выберусь и снова займусь всеми делами.

С секцией дело сложное. Она слишком хорошо работала в Совете, что вызвало раздражение некоторых [illegible] совета и особенно — освобожденного ученого секретаря — работника ГНТК, которого мне пришлось [illegible] за плохую работу, а он работать не хочет. В связи с этим в конце [illegible]

....

Пока я был в больнице, председатель [illegible] утвердил состав совета по [illegible]. Тем [illegible] другое — [illegible] и [illegible] и [illegible]. [illegible] секция [illegible]:

Председатель — Семенов
Зам. председателя по физ.-хим. вопросам — В.И. [illegible]
Ученый секретарь — " — — Б.Н. [illegible]
Зам. председателя по [illegible] — П.С. [illegible]
Ученый секретарь по физ.-хим. вопросам — Л.И. [illegible]

Подсекции — 1) по [illegible] — рук. [illegible]
2) по соединениям РЗМ — рук. [illegible] —
— эти подсекции находятся под вашим наблюдением.

Как Вы к этому относитесь? Жду ваших писем и предложений

....

Жду и письма от Вас.

В [illegible] конечно не приеду — не [illegible] больницы.

В больнице даже время не идет — требуют [illegible], [illegible], [illegible], всякие вещи, [illegible] [illegible] [illegible] — [illegible] [illegible], [illegible] и [illegible] работы.

А пока — [illegible] [illegible], в больнице [illegible], [illegible] не [illegible] [illegible] [illegible] все [illegible].

Желаю всем [illegible] и [illegible]

Ваш [illegible]

MY SCIENTIFIC ADVISOR

A.A. Adamovskyi
Doctor of Engineering Sciences,
IPMS of the NAS of Ukraine

Grigorii Valentinovich Samsonov was my scientific advisor during my graduate course at IPMS. Before entering the course, I had served in the Soviet Army of the former USSR, being engaged in the operation of the AN-12 military transport aircraft. Therefore I appreciated the strict discipline that Samsonov upheld at his department. For example, every weak each graduate had to come to his office at the appointed time to report on the work done. The office had a long table covered with fresh scientific journals from all over the world, which Grigorii Valentinovich bought at his own expense. We should not waste time, instead should look through the latest scientific journals while Grigorii Valentinovich was talking to some of us.

Grigorii Valentinovich loved working with young people. During my studies, I headed the graduates' board. Under the guidance of Grigorii Valentinovich, the board had to hold annual spring conferences of graduates and young researchers, to collect materials of the conferences and to publish them, as well as to organize the scientific program "Abrasive materials". The purpose of the program was to bring the scientific developments of the Institute to industrial application. Grigorii Valentinovich believed that the mastering of scientific research findings by industry is a key task for science. I was appointed academic secretary of the program. In the frame of the program, abrasive paste based on titanium carbide and a new tool material, hexanite, were developed.

Grigorii Valentinovich distinguished himself as a high organizer of his working day in detail. His ability to work was unlimited. He himself worked enthusiastically and fascinated others. I think that work in his life was of dominant significance. He inoculated diligence into graduate students from the first day of study.

For an example, let us consider his one working day. As I remember, that day I saw Grigorii Valentinovich three times. First, according to the schedule, at 9:00 AM we met at a weekly consultation. At about 2:00 PM I was invited to report about the preparation for an annual spring conference of young researchers from several academic and educational institutions. At the end of the working day (4:00-5:30 PM), employees of the sector, as often, gathered in the graduates' room, and Grigorii Valentinovich gave them a lecture. After the lecture, the graduate student Sychov handed Grigorii Valentinovich a chapter of his dissertation, then came to my place and said, "While he is reading it, I will be having a rest for several days." On the following day at 9:05 AM, the secretary called Sychov to Samsonov. Sychov was absent but came running at once, went to the reception room, then returned and said, "Well, my rest is over. Samsonov just returned the chapter with remarks, corrections, and instructions. And a new task is to prepare the following chapter."

Grigorii Valentinovich set clear tasks, discussed the results obtained, and gave instructions for preparation of articles. He looked through the first version of an article, made comments and corrections. If everything was well described, at the end of the article he wrote "to be published". Articles bearing this mark of Grigorii Valentinovich were regularly printed in scientific journals. I do not remember any case that an article with his mark did not pass a review.

G.V. Samsonov kept in touch with his graduate students over all his life. He was interested in the work of the former students, their new achievements, invited them to conferences, symposiums, and workshops. He was a caring mentor who supported our creative spirit and encouraged scientific growth. Grigorii Valentinovich was like a father for his graduate students and young colleagues. I am infinitely grateful to him for the given instructions and a pass ticket to the world of science.

G.V. SAMSONOV IN MY LIFE

The acquaintance and communication with such a person as Grigorii Valentinovich leave a mark for the whole life. I was fortunate to get to the graduate course under his leadership. The pace that at once was proposed by my scientific advisor not every student was able to withstand.

I did my best. But the fear of a mighty man who was madly in love with science absolutely paralyzed me, which was particularly evident during consultations in Samsonov's office every Friday, where I hardly could utter a word.

For each of his graduates Samsonov had a folder ("dossier") with short reports on the weekly activity. While the chief was talking to one of us, the others had a chance to look through scientific periodicals, including foreign editions, spread out on a long desk.

Samsonov immediately caught everybody’s problems, including my fear of manifesting myself. Therefore, I was given an individual task: he invited me to KPI, where he briefly outlined the problem which interested him and which I had to worry about for three years of studies. At last, I was forced to open my mouth to express my opinion. After such expierence, fears disappeared, and I communicated with the chief at ease.

Each communication with Samsonov inspired me to work hard. "The main thing is not to lose the pace!" he said, and with these words his students cheered each other. Even when Grigorii Valentinovich left us never to return, the graduate students, whom he "brought up" like little children, did not lose the race that they used to keep under his strick concern in their work.

Samsonov died two years before my dissertation defense. But he was in my thoughts for these two years. I compared my new ideas with possible his and discussed them as if he were beside. I express my unlimited respect to his former graduates, who, in memory of him, sent me an incredible number of remarks on my dissertation summary from all the corners of the USSR.

I admired Samsonov, his ideas, and his attitude toward people. May the memory of him be eternal!

L.A. Ivashchenko

Candidate of Engineering Sciences, IPMS of the NAS of Ukraine

UNFORGETTABLE CORRESPONDENT

R.A. Andriyevskyi
Corresponding Member of AS of Kazakhstan, Institute for Problems of Physical Chemistry of RAS

G.V. Samsonov was an outstanding scientist and a great organizer of research and developments. He remains as an example of a genuine internationalist and patriot, being a Saint-Petersburg scholar by origin, a Muscovite by education, and a Kyivite by intense scientific creativity for twenty years in this city. "Sense of a friendly family" (title of P. Tychyna's verse) was inherent in him to a high degree.

Colleagues from many domestic and foreign cities stretched to him and he generously shared his experience, knowledge, and acquaintances with them. Many of his correspondents turned to him for advice and even with requests, and everyone could count on his attention and support.

He surprised and stroke everyone with his tremendous work capacity and brilliant memory. Despite his efficient administrative and scientific activities, he always found time for letters. He used to say, "One of the distinguished traits of an intelligent man is answering letters with no delay." And so he did.

His epistolary deserves a thourous examination, but I will confine myself to laying out only individual episodes. We corresponded for thirteen years, and about thirty of his telegrams, postcards, and letters are still kept in my archive. These generous, emotional, and witty letters were and remain for me as peculiar catalysts.

In addition to letters, he sent references, reprints, books, and editions of the Institute. The letters contained such things as ideas of the possible existence of certain phases, for example carbohydrides, which became an impetus for further large series of our joint works on their synthesis and thermodynamic, structural, and physical properties as well as on NMR spectra, and so on.

Our correspondence was friendly and frank. I remember, after my speech at one of the seminars on the configuration model of matter *against* the model, I received the following letter:

January 17, 1966

Dear Rostislav Aleksandrovich,

With great regret, I learned about your criticism and, as I was told, your vicious speeches against my *ideas at the seminar held in the spirit of " a la Umanskii". Therefore, to tell the truth, I did not really want to answer you, since your bias cannot be changed. Nonetheless, the habit of responding to every letter took its own, so I am performing my duty ... "*

The following three pages were devoted to description of stable configurations, *"... for which I, together with my students, am surrounded by the sea of malicious attacks, but without which there can be no serious discussion about the creation of materials with predetermined properties. I am firmly sure that with time our opponents will be convinced that the model is fruitful. We must only work hard and find the required moral and physical strength in order not to go along a common, easy, and calm path, but to look for deeper, at least in qualitative aspects, paths.*"

Of course, the configurational model of the electronic structure may be treated differently, but one cannot but be amazed at the scope of the plan, at the desire to create a universal theory for interpretation and prediction of the properties and structure of metals, alloys, and compounds.

Grigorii Valentinovich did not thwart evil on his critics. Moreover, he could rejoice at the successes of his colleagues, encouraging them to do new things. Shortly after my criticism, he introduced me to Academician A.Ye. Sheindlin with the best recommendations for my possible work at the Institute of High Temperatures of AS USSR.

Always purposeful, aware of his value, seemingly closed and inaccessible, in letters he allowed himself to relax, to share his troubles and cares. On September 15, 1974, he wrote, "*The Institute represents the same picture. I feel more and more like Haile Selassie: all my rights become step-by-step narrower and limited, I am waiting for deportation, I am thinking of a 'political asulam' or the preservation of a separate feudal village for my department."*

Finally, from the hospital (where he continued to work intensely), I received two last letters, which cannot be read without emotional excitement and which I present completely.

Octiber 17, 1975

Dear Rostislav Aleksandrovich,

Thank you for the letter and the reprint I was very pleased with in my exile... I still hope for the better when I will be able to return to work, maybe, by the October holidays.

It would be very interesting to read your Riga report, and I wait for your book written with Skorokhod about sintering – this is a powerful team of authors.

We are all working on reference books, we have published three at once: "Properties of elements" in two parts, "Refractory compounds", and "Physical and chemical properties of oxides". Well, essentially, now I am most interested in the idea of writing "Electronic Chemistry" on the basis of configurations for a wide range of chemists. In general, I have enough work, even in the hospital: most time I am correcting various of manuscripts.

Best wishes,
Your Samsonov

December 15, 1975

Dear Rostislav Aleksandrovich,

The day I received your letter was very bad for me. Fortunately, somehow my condition and mood have changed for the better. Thank you for the letter, thank you very much. I experience terrible weakness, the right hand doesn't work, absolute aversion to food, and dizziness. X-ray radiation has provoked all this, the doctors may have overdone.

Still, I hope for the better.

Thanks again for all, dear friend.

A few days later, I received, at the same time, New Year's wishes from Samsonov and a telegram imforming about his death on December 22.

I wrote my condolences to his wife and received a reply letter, which highlights many wonderful qualities of Grigorii Valentinovich:

January 30, 1976

Dear Rostislav Aleksandrovich,

Thank you for your kind attitude to the memory of Grigorii Valentinovich. He left us all very early and unexpectedly. I did not answer you at once, since I stayed in the hospital, the same place where Grigorii Valentinovich passed away. Our balconies are so close that I think the same tits and sparrows that he fed fly to my window today.

...All the feelings and qualities of Grigorii Valentinovich were extraordinarily capacious and noble. He was a skilled expert in many fields of science, and he experienced the laws of physics and biology as a common matter with himself, as "living in the living". These words are not probably to the point, but Grigorii Valentinovich, jokingly or seriously, called himself a newcomer from other worlds. He was a dreamer, and this saved him from the brutal blows of the earthly life, including the suffering of the last months of his life.

Nature generously gifted him not only with talents, but also with high feelings and rare, wonderful human qualities. He often said that he would die soon, that he needed more time, and that his work would be appreciated after his death.

As for me, I have two children left, our grandchildren, the care of whom Grigorii Valentinovich once took.

Finally, I remind you the motto of Grigorii Valentinovich's favorite character Don Quixote:

Dream, though dreams won't be realized,
Fight when outgunned,
Search for overwhelming tasks,
And live to the end of time.

Faithfully yours, N. Samsonova-Kibalchich

I am deeply grateful to the destiny which gave me the happy opportunity to be acquainted and to be friends with this great scientist and wonderful person.

MY AGE-MATE

T. Ya. Kosolapova

Doctor of Engineering Sciences, IPMS of the NAS of Ukraine

In 1953 I was charged with the duties of head of the chemical laboratory at IPMS. It was not a real official position, rather a kind of public activities, that is, with no payment for it. We were considered to be a service laboratory and hence could not be fully engaged in science, although we carried out required special scientific developments.

I happened to see G.V. Samsonov for the first time quite unexpectedly. Once entering the laboratory, I found a very cumbersome picture: in the middle of the laboratory, a handsome man was standing, and all my co-workers bustled around him, providing him with medical assistance, "He has scratched his finger!" In such a funny way I got to know Grigorii Valentinovich, who played a huge role in my life.

Samsonov was my age-mate. This means that we, unlike most of our co-workers, had gone through the hard time of World War II and Stalin’s regime. Consequently, we, of course, respected hard work, strict discipline, responsibility, social duties and did not avoid unpaid work on weekends or vacations. We never gave priority to material stimuli. Pragmatism was alien to us.

Samsonov was never a scientist who sought his further career or worked for recognition only. But he had some definite material needs to satisfy, which he grouped around two items: the upkeep of his family ("I am the only breadwinner", he used to say) and purchase of books (he spent a quarter of his earnings on books, journals, and various other publications, many of them foreign). We worked together amicablely and trustfully.

Grigorii Valentinovich never rested at ease. He worked at home on weekends; during his vacations he lived alone in the country and worked. In the course of our joint work, those short twenty years, there was no case when he had a rest for at least a few days, and there was no day when he was unwell. As a result, dozens of monographs and over 1.000 articles were published.

Possessing enormous organizational capacities, he managed to rally around himself a large number of experts from various cities of the country.

The equipment on which we worked was handmade and far from modern. Practically, all the units were of indigenous origin, exept electron microscopes. Most of the high temperature furnaces were assempled in the Institute's workshops. Nevertheless, Samsonov warned everybody that one who would complain about terrible work conditions would be expelled. He constantly argued that good work can only be performed under harsh conditions when one has to reproduce the results, think over them, and generalize them. Difficulties make brain be bright, whereas findings obtained with excellent modern equipment dampen the ability to analyze deeply and do not make one think. Perhaps this is true. We never worked on modern equipment and thus could not compare and get to know if this is true or not.

Once Samsonov, being in Moscow, met Academician N.N. Semenov, Vice President of the USSR Academy of Sciences, the first Soviet winner of Nobel Prize, who wanted to get acquainted with our work closer. Samsonov asked me to inform him about our researches. After my presentation, Semenov phoned many well-known scholars and asked them if all that I was talking about may be possible. At the end of the discussion by phone he said that we should unite our works, since IPMS did everything but understood nothing, while they understood everything but did nothing. Consequently, our team was included, as a separate section, in the Scientific Council on Heat-Resistant Inorganic Materials under the Academy of Sciences of the USSR, headed by N.N. Semenov.

In addition, there was another area of our activity, namely preparation and publication of scientific monographs and reference books, the success in which we fully owed to Grigorii Valentinovich. We were very proud of the fact that all of our handbooks released under his leadership were translated into other languages and published in other countries including the United States and Japan.

In October 1975, Grigorii Valentinovich and I were supposed to go to Poland for a conference with reports. On the eve of the departure, the secretary called me and said that Samsonov was unwell and could not go abroad. It was very strange as over all the years of working together, he had not suffered from any disease, and I was surprised that he did not call himself. I went to Poland alone and, on returning home, found out that Samsonov had been urgently taken to the hospital. The doctors revealed lung cancer. Probably, this happened because he smoked a lot: having finished one cigarette he immediately started another. In November, he was released home for several days. After that he came to the Institute and summoned me. He looked very tired, exhausted by the disease. When he said that he had come to say goodbye to us, I was stuck in my throat and could not say a word, but soon collected myself and, smiling, said that one who had never been sick may consider a cold as a serious disease. He asked if I really thought so, and so much entreaty and hope appeared in his eyes.

Samsonov's contribution to science as well as his help to a great number of people whom he brought up to scientific society cannot be overestimated. All of the scientists who were raised by him keep the traditions traced to them, *i. e.*, they teach and educate young people, actively continue all that he began and developed. Every year on his birthday they hold scientific seminars devoted to his memory.

MY FIRST TEACHER IN SCIENCE

Samsonov has shown
How to serve science,
Not searching for prizes,
Not sleeping of boredom.
AUTHOR

My acquaintance with Grigorii Valentinovich took place in 1958 after the resolution of the Central Committee of the CPSU and the Council of Ministers of the USSR on works in the field of thermal elements for the development of nuclear energy. According to the resolution, certain research was to be carried out in the field of high temperature materials, and the design and manufacture of high temperature (up to 2500 °C) electric furnaces were to be organized.

The All-Union (now All-Russia) Institute of Electric Engineering had to study the properties of commercial grades of graphite, including electrical resistivity, thermal conductivity, linear expansion, evaporation rate, creep, and coefficient of friction at temperatures up to 2500 °C. To fulfill all this, the Institute designed special equipment.

At IPMS, the related studies were conducted under the guidance of G.V. Samsonov for carbides and nitrides of metals belonging to subgroups 1VA and VA of the periodic system of elements. Samsonov's part consisted in organizing technological processes for fabrication of samples aimed at determining thermodynamic, structural, chemical, and some other properties.

The joint work of IPMS, VNIIETO, and VNIITS made it possible to select niobium carbide as a suitable material for design and industrial manufacture of vacuum electrodes for high temperature furnaces.

The work was awarded the Sobolevskyi Prize (1978), the most prestigious award in the field of powder metallurgy.

Over seventeen years I was in touch with Grigorii Valentinovich concerning the field of high temperature materials science. As a result, I acquired profound knowledge, which is still of use. In 1963 under his unofficial leadership, I defended my candidate dissertation. He helped publish my

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monograph "High Temperature Materials" (1967) and reference book "Carbongraphite Materials" (1973) in the "Metallurgy" Publishing House.

Trying to follow his amazing persistence in research work, I managed to make two discoveries in the area of high temperature materials science, N 138 and N 152. I am sure, he would be glad that his surprisingly attentive attitude to me yielded good results.

Practicing high temperature materials for vacuum furnaces and installations more than half a century, I have never forgotten my first Teacher Grigorii Valentinovich Samsonov. I am grateful to the destiny which brought me to such an amazing person. It is very insulting that he died so early, in the prime of his creativity, full of the passionate desire to work and to carry the torch of science to the world.

IN MEMORY OF SAMCONOV

In 1958, on graduating from the Faculty of Physics at T. Shevchenko National University, I was appointed to Kyiv Motorcycle Plant where I was entrusted with the task of creating a site for powder metallurgy. In particular, I worked on concordance of technical documentation with IPMS. There I met Grigorii Valentinovich Samsonov, who was Deputy Director of the Institute. At the first glance, he seemed a very serious person and pretty busy. Soon he offered that I come to work at the Institute, and I readily accepted the offer. I was engaged in the development of technology for manufacturing articles made from materials based on refractory compounds.

Once I prepared a paper on titanium carbide pressing. We discussed all the results and conclusions. There were two authors; G.V. Samsonov was the first. He read the last version of the paper, did not make any remark, and said, "Remove my name from the authors. It is enough for me if you thank me at the end of the paper". And such a situation repeated several times.

In the 1960th under Samsonov's leadership, we developed evaporators based on titanium and zirconium diborides and introduced them into Brovarskyi Powder Metallurgy Plant. Then our evaporators were used in the units of vacuum metallization in the production of aluminum coatings on polyethylene terephthalate films at Riga Technical University (Latvia). In such a way we reached our first economic effect of 800.000 rubles. Samsonov was very proud of this work.

Grigorii Valentinovich was amazingly keen on animals. At that time IPMS was located on the territory of the Pecherska Lavra. Every day at the Economic Gates, he met a stray dog. To feed it, he usually came to the Institute ahead of time and always brought a packet of dog food. When the Institute moved to Sviatoshyn, he fed masterless dogs around the Institute. And when he went on vacation, he gave us money for dog food.

We always recall our Great Teacher with a kind word and thanks. May his memory live forever!

L.I. Struk
Candidate of Engineering Sciences,
IPMS of the NAS of Ukraine

DREAMER, FIGHTER, WINNER

T.V. Dubovyk
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In 1958, I began to work in Department 7, led by G.V. Samsonov, on the development of technology for production of powder nitrides of transition and other metals. Samsonov very actively participated in the production of these new compounds, including magnesium nitride, which could be synthesized not only from powder, but also from magnesium chips. It turned out to be very unstable and decomposed owing to the interaction with air humidity. During one of our business talks, Samsonov suggested that as-prepared product should be immediately sealed into a glass ampoule. Suddenly he himself took some melted iron and a test glass tube and showed how it should be done. He reacted so actively to the production of powders of rhenium, cobalt, and aluminum nitrides. I could give many such examples. He was never indifferent to our findings and was happy on obtaining new interesting materials.

In 1959, the prepared technological instructions for obtaining nitride powders were delivered to Donetsk Plant of Chemicals. At the plant, a special place was allocated for the process of mastering nitride powder production technology, where all the necessary equipment and even reagents were brought from our Institute.

Over the following ten years, technologies for production of not only nitrides, but also borides, carbides, silicides, sulfides, and other compounds were developed and introduced in the plant, and a semi-industrial release of these compounds started. Donetsk Plant of Chemicals was the first enterprise in the USSR that produced such products.

Under the scientific guidance of Grigorii Valentinovich, our Institute developed technologies for obtaining sintered and hot pressed samples from aluminum nitride powder; their properties were investigated, and finish products were implemented at three enterprises in Saint-Petersburg: VAMI (lining plates of electrolyzers for aluminum production from aluminum chloride or cryolite-alumina melts); the association "Svetlana" (lining plates for furnaces in zinc production), and GIPH (catalyst carriers based on aluminum nitride) as well as at Brovarskyi Powder Metallurgy Plant (lining slabs of pallets for iron sponge production and sintering of articles made from iron powder).

In parallel to such activity on introduction of scientific results into industry, G.V. Samsonov proposed his theory of stable electron configurations, with the help of which one not only could explain properties of different compounds, but also even foresee them. Basing on it, he predicted high electrical insulating properties of a material consisting of boron, nitrogen, and carbon. His forecast came true.

Under the guidance of G.V. Samsonov, the employees of his department developed an industrial technology for producing boron nitride powder and introduced it to Zaporizhzhia Abrasive Plant. On the basis of this plant, G.V. Samsonov founded Zaporizhzhia branch of IPMS. The workers of the branch and IPMS developed several versions of composite materials of the "B-N-C" system. The optimum version was the technology for producing an electrically insulating material based on boron nitride and boron carbide (boron carbonitride, or conditionally BNC) using the method of reaction sintering. Products from this material exhibited high electrical insulating properties, high heat resistance and thermal conductivity, low coefficient of thermal expansion as well as high resistance to the action of silicon-boron alloys up to 2000 °C, molten silicides, nickel and cobalt based alloys, cryolite-alumina melts, liquid aluminum, and high-alkali slag within 1500-1700 °C.

Products from BNC (jackets and straws of various diameters for tungsten-rhenium thermocouples, crucibles, insulators of various shapes and sizes, lining plates, sleeves of various sizes, *etc.*) were sent to enterprises of Moscow, Saint-Petersburg, Novosibirsk, Krasnoyarsk, Gorkii, Riga, Lviv, and other cities. To investigate the properties of BNC, samples of various shapes and sizes were delivered to more than 500 organizations, most of which performed works according to agreements or treaties of cooperation. To crown this hard work, in 1969 the State Prize of the USSR was awarded for the work done.

G.V. Samsonov simultaneously supervised up to 25-30 graduate students, with whom he conducted systematic work. As a rule, the graduates gathered in his office weekly on Friday and reported on work done during the previous week. Each of them received comments and necessary recommendations. All of his graduates always successfully upheld their dissertations, including those applicants who lived in other cities.

G.V. Samsonov possessed incredible capacity for work. He usually spent his annual vacation at a rent cottage near the Institute and continue to work. A system of interaction with Institute was set up: every day after work, somebody took official papers from Institute for a signature as well as articles and reports for a review, and the following day he received back the reviewed papers.

In 1964, G.V. Samsonov created a team of three people to prepare applications for inventions. Very shortly, the small team turned into a high-efficient Patent Department, which provided the staff with qualified assistance in obtaining required patents and scientific-technical literature, as well as in filing applications for inventions in the field of development of new materials and devices made from them. The Patent

Department arranged patent courses for the Institute staff, after which the students received diplomas. In total, since 1964 to the present, the Institute received over 2000 certificates of authorship and patents for inventions.

For all of us, G.V. Samsonov was a true teacher. He taught us not only materials science, but also moral principles, as evidenced by his statements, "*It is immoral not to return books, not to reply to letters, and not to be on time for work", "Thought is always ahead of reality, so think more!", "All of us know very little, do not waste time and study", "Every work, even a weak one, may contain something useful", "I cannot afford to sleep more than four hours a day, I have so little time"*, and many others.

The ex-libris for Samsonov's library (author S.S. Kaplan) contains an image of Grigorii Valentinovich's favorite character Don Quixote, whose motto was very close to him.

Dream, though dreams won't be realized,
Fight when outgunned,
Search for overwhelming tasks,
Live to the end of time.

The image of Grigorii Valentinovich will live until the "end of time" in the souls and hearts of all he trained, who worked with him, met him, was acquainted with his numerous scientific papers, and those who today continue the work he started.

MY UNFORGETTABLE TEACHER

L.N. Pereselentseva
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When in 1969 I was admitted as a graduate student to IPMS, Grigorii Valentinovich Samsonov had already supervised up to thirty people (plus ten at KPI). For me, a young specialist, he was a personality of a huge scale. I had been told that he was very fond of science, and thus he could not even imagine that someone could prefer something else for pleasure to science. As an example, I would like to narrate a story typical for work under Samsonov's direction. In the first year of graduate studies, I decided to spend my two-month summer vacation on a seashore. Before that, I had been given a task to write an article on the results of my work. But I went to my homeland and absolutely forgot about the article: the sea, the sun, the beach...

A month later I, relaxed and tanned, returned to the Institute, and at the following audience (on Friday, in turn, for 15 min) he asked, "Where is the article?" No article! Then Grigorii Valentinovich called up Tetiana Vasylivna Dubovik, my senior co-worker, and started a quiet "confidential" conversation with her as if I were absent, "I have a graduate student, Pereselentseva. She does not want to work, does not fulfill her tasks. What do you think we should do with her?" Tetiana Vasylivna blushed and kept silence, not knowing what to say. Grigorii Valentinovich went on, "I think if she does not want to work, let her leave the graduate school, there will appear others in her place who will want to work." After these words Grigorii Valentinovich turned to me and said with a kind smile that I was free. Of course, later on I did not dare lie in the sun during all my graduate studies.

In 1974, the defense of my dissertation passed successfully. Grigorii Valentinovich spoke at the dissertation council meeting with an excellent assessment of my work, and I did not doubt that the work would be approved by the Higher Attestation Commission (HAC) of the USSR. However, I had to defend my work again at the expert council of the HAC in Moscow. The matter was that the reviewer for my work was Professor G. C. Kreimer, with whom G.V. Samosonov had no good relations. The review of the "black" opponent seemed to me "murderous". Moreover, Grigorii Valentinovich was taken to the hospital. The situation became critical. Nevertheless, the mortally sick Teacher found strength to support me. He asked his former student V.K. Vitrianiuk to help me respond to the reviewer's comments. I prepared good replies with him, and, having left my six-month-old daughter in her grandmothers' care, went to Moscow, to HAC.

I managed to persuade the HAC members that the work was promising for the development of new reinforced composites in the field of wear-resistant hard alloys. It was already after the Master's death. Thus, thanks to the posthumous participation of Grigorii Valentinovich in my destiny, I received a candidate's degree.

I will always remember Grigorii Valentinovich Samsonov, his care, his kind heart, and the life school that he taught me.

STEP-BY-STEP UNDER SAMSONOV'S LEADERSHIP

G.V. Lashkarev

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I got acquainted with Professor G.V. Samsonov long ago, in 1960, after my graduation from Lomonosov Moscow State University and coming back to Kyiv. I got to work for him by my father's advice.

At first, Grigorii Valentinovich offered me an engineer post. And the first task was to assess the opportunity to use refractory compounds as materials for thermoelectric generators. He permitted me to perform this task at the family's summer cottage, where we had a big scientific library. Two weeks later I submitted a detailed account on the subject with required calculations and the conclusion that the best thermoelectric couple is $CoSi/MnSi_{1.73}$. But some months later I noticed a mistake in my calculations (which did not change the final conclusion) and told Grigorii Valentinovich about it. He said with a kind smile, "For such a mistake I move you to a higher post – a senior engineer."

Samsonov introduced me to the scientific team dealing with measurement of electric conductivity and thermal electromotive force of refractory compounds. In addition, he once sent me to the Presidium of AS USSR to get acquainted with the information on magnetohydrodynamic method of power generation. As a magnetohydrodynamic generator operates at high temperature, it seemed to me promising to use refractory compounds that could stand aggressive media at high temperature as materials for such generators. This conclusion gave rise to a new trend in the department researches – investigation of magnetic characteristics of refractory compounds.

The theme of my candidate's work was "Selenides and tellurides of rare-earth metals". Grigorii Valentinovich appointed Dr. Yu.B. Paderno to be my scientific advisor. Because of the lack of suitable equipment, first of all, I, together with department engineers, designed a special high temperature vacuum unit for measurement of electric characteristics to be assembled at the Institute's workshops. Herein Samsonov taught me a lesson, "Make two copies of detail drawing, as the first thing they do — they lose drawings." And he happened to be right!

Despite Samsonov was not my official scientific advisor, he was permanently interested in my work.

Sometimes, he even invited me to his place to discuss some items of my future dissertation. Also, he advised me to write books, namely "Selenides and tellurides of rare-earth metals and actinides" (together with V.A. Obolonchyk) and "Direct transformation of different types of energy into electric energy" (together with V.S. Fomenko and A.M. Taranets), which were published in the Publishing House "Naukova Dumka". Additionally, I took part in the writing of the reference book "Physicochemical Properties of Elements", which is still in demand today.

In such a way, Samsonov led me along the path of science step-by-step. As I have realized, he was beside me on each turn of this path and prompted the right choice at crossroads.

After teaching me how to write and publish books, he insisted in my going abroad to take part in various scientific meetings. For this, I had, firstly, to learn English and, secondly, to attend the department of international relations at the Presidium of the AS of USSR with various errands to be known there. When I first went abroad, to Prague, I was equipped with the addresses and telephone numbers of Samsonov's friends and colleagues, who indeed helped me much.

When our families lived at the same apartment house on Sverdlova Street, I often saw Grigorii Valentinovich walking with his beloved dog. He liked animals very much. Every morning on his way to work he fed masterless dogs around the Institute. When he was asked why he did not have a car, he answered, "For what? All Kyiv's trolleybuses are at my disposal."

He was a prominent personality and, at the same time, a man "in flesh and blood", good-hearted and delicate. In memory of him, I always use his favorite short phrase "With best wishes" at the end of my letters.

HOW I BECAME A KING OF CARBIDES

V.Ya. Naumenko
Candidate of Engineering Sciences, Drahomanov National Pedagogical University

While a forth year student of the metallurgical faculty of KPI, I attended lectures on powder metallurgy delivered by Professor Samsonov, whom we, students, listened to with great interest and even curiosity. We communicated now and then, and once he suggested that I enter his graduate course and take up the development of technology for obtaining carbides of Group IV-V transition metals in the homogeneity region and study their electrophysical, mechanical, and chemical properties. I gladly agreed to this proposal.

Grigorii Valentinovich had a lot of graduate students at that time. The majority of them had to use electric vacuum furnaces. Since this equipment was not sufficient for everyone, according to the instruction of Grigorii Valentinovich, a round-the-clock schedule for graduates' work was drawn up, and we synthesized and sintered materials in turn at night. Every Friday we had to inform our chief about the work done, and, God forbid, something planned had not been fulfilled. I remember the case when there was no technological water for two days and I did not have time to obtain titanium carbide in the homogeneity region. Grigorii Valentinovich said, "This happened for the first and the last time. If there is no water, you must tell me, and I will arrange preparation of carbides elsewhere."

Samsonov organized annual scientific conferences for graduate students and young specialists. The graduates' room regularly worked. We were also attracted to lectures for KPI students. He once told me to be ready for delivering a lecture on the topic "Carbides of transition metals in the homogeneity region". Seeing some fear in my eyes, he said, "Dear Vladimir Yakovlevich, a graduate student knows more in his small field of science than an academician."

Almost all of the properties of carbides of Group IV-V transition metals in the homogeneity region were pretty well interpreted in terms of the configuration model of matter with taking into account the energetically stable d^5 configurations of metal atoms and sp^3 configurations of carbon atoms.

During the study of electrophysical and mechanical properties of the $NbC_{0.82} - TaC_{0.85}$ carbides, we found extreme values of their properties. Grigorii

Valentinovich noted that these findings were consistent with the data of the famous Swedish scientist D. Ramquist. He said: "Prepare such samples, and I will deliver them to D. Ramquist in Sweden in order to check your results." A month later, he called me up to his office and read a letter from D. Ramquist, in which the latter informed that the extreme electrophysical and mechanical properties of our samples had been confirmed in tests with using his modern equipment. Samsonov, with his charming and charismatic smile, said, "Well done, now you are the king of carbides in the homogeneity region." Later on up today my graduate students have called me "the king of carbides".

The horrific death of Grigorii Valentinovich caught me during a business trip in the city of Sverdlovsk, but I managed to fly to his funeral.

Samsonov instilled into us a great love for science and interest in researches. I think the development of powder metallurgy by Samsonov's former students and followers is the best monument to this great scientist and teacher, the memory of whom will always live in our hearts, for he gave all of us a great opportunity to live a creative life.

MEETINGS WITH GRIGORII VALENTINOVICH

Yu.V. Dziadykevych
Doctor of Engineering Science, Ternopil National Economics University

The name of Grigorii Valentinovich Samsonov arises in my memory with special gratitude. Thanks to him, I determined my direction of scientific work, to which I have devoted more than forty years of my life. Recalling the well-known statement of N. Berdiayev that "man is the Universe and a personality", I would like to emphasize that the universe of the personality of Grigorii Valentinovich was included in the tireless service for classical science and education of young talented scientific intelligence in Ukraine.

I first knew about G.V. Samsonov as an outstanding scientist in the field of materials science from his scientific publications. He was not my official scientific advisor, but several meetings with him proved to become decisive for me and remembered forever.

The first of them happened in May 1970, after submitting papers to the graduate course at IPMS. He attentively listened to my plans for future scientific work and suggested the topic of a scientific essay required by the entrance rules. I did by best and in September submitted the essay. The impression of the conversation with Grigorii Valentinovich that took place after that surpassed all my expectations. I was given the highest grade and such encouraging words that I was stunned and thus inspired to begin serious scientific work.

I recall another episode from my graduate life, when G.V. Samsonov's responsiveness, attentiveness, and care played one of the key points in my scientific training. At the beginning of November I received a copy of the order about my enrollment to the graduate course of IPMS, but the administration of the institute where I then worked did not allow me to cease my tutor's duties and recommended to take a correspondence form. I decided to contact Samsonov and told him everything in detail. He said, "Do not worry. We will send a letter to your management, and they will release you. Come and begin your scientific work." And a few days later, I was already a full graduate student!

Once at the beginning of studies, Grigorii Valentinovich met with the newcomers and the first question to us was: "How have you got settled? Is everything OK?" Then the graduates were distributed to the department laboratories. Addressing me, he said, "You will work in the laboratory of Dr. A.L. Burykina, and she will be your scientific advisor. We have chosen a dissertation subject. As for me, I will watch closely the progress of your research." From this point on, my scientific work started, devoted to the problem of developing and refining composite materials, which then only began to be applied in various fields of engineering. And today they occupy a prominent position among the materials with special physicomechanical and chemical properties. This fact testifies to Grigorii Valentinovich's strategic thinking and ability to anticipate the future of science.

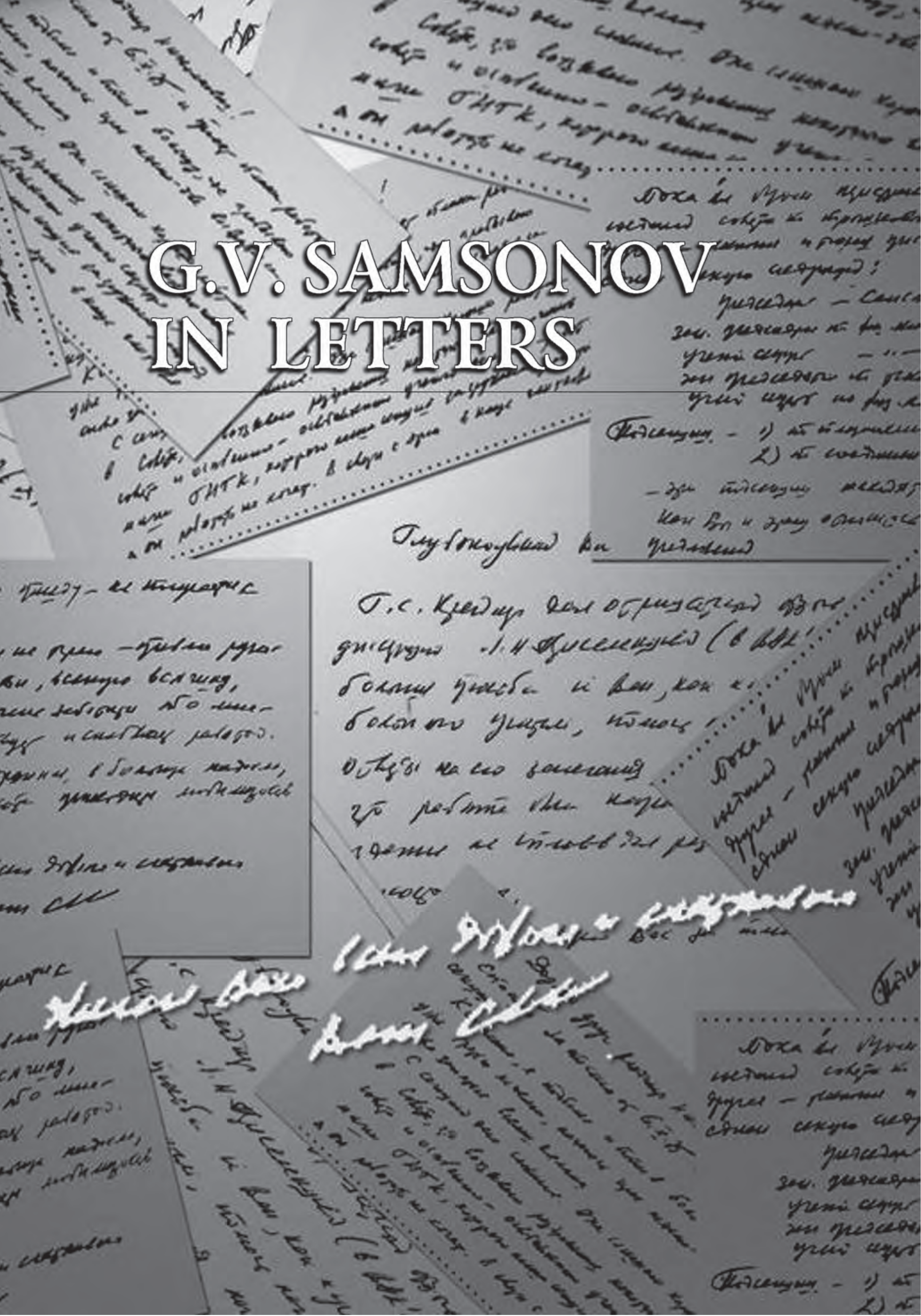
Grigorii Valentinovich often attended the laboratories, where graduate students conducted experiments until late in the evening, questioned them about the results of work and, if needed, immediately gave advice. Thanks to his constructive help, I completed the dissertation work in advance.

Another unforgettable conversation with Grigorii Valentinovich took place on the eve of the end of my graduate course. He offered me to stay at the department, but I had other plans. Surprised by my decision, nevertheless, he sincerely wished me good luck.

My last meeting with Grigorii Valentinovich happened at the Uman conference in 1975. I told him about the foundation of the laboratory "High temperature materials and coatings" in the city of Ternopil, its directions of research, material and technical base, relations with other enterprises, and so on. He approved my information, gave valuable pieces of advice, which we then used in our further work, and even promised to visit our laboratory at the first opportunity. At the end of the conversation, he said, "Try to increase plasticity of refractory metals, as the high fragility of molybdenum and tungsten is an obstacle to their successful introduction into high temperature technology." It is worth noting that we have solved this problem. And many other achievements of our laboratories are based on the scientific works of Grigorii Valentinovich.

Scientists and tutor-guides like G.V. Samsonov will always be cornerstones in the foundation of world science.

G.V. SAMSONOV IN LETTERS



G.V. Samsonov kept up correspondence with a large number of scientists and he had all the qualities of a gentle and attentive friend behaving in the same way both toward his juniors and his seniors.

Dr. P.N. DZHAPARIDZE (Georgia)

Below are fragments from G.V. Samsonov's letters in the period 1963-1975.

November 12, 1963, to S.Ya. Plotkin

...I have begun to reorganize work in my laboratories, particularly in the laboratories for quantum generators, semiconductors and dielectrics, cathode electronics, superconductance, etc. I think we will be successful and obtain some interesting results and materials...

October 1969, to S.Ya. Plotkin

I have many interesting subjects to study ahead: dielectrics, semiconductors, physics of solids, refractory materials, my electronic ideas... The very thought of all the opportunities makes me feel dizzy. There is such an abundance of interesting work to be done, but sometimes one encounters such barrenness that it is difficult to proceed. To me, my greatest source of joy is the exhilaration I feel when 1) I have successfully trained a skilled Doctor of Sciences; 2) I managed to implement my findings in practice; 3) my data are used as reference; 4) I am a winner in a scientific debate; 5) a good book of mine has been published, and 6) I succeed in arriving at a new scientific idea.
The order may be reversed. I do not know what your scientists and psychologists think, but each of these items is for me the most important.

August 29, 1968, to S.Ya. Plotkin

Formal festivities are a great chore for me... I am deeply moved by sincerity and gestures that come from the heart; I respect them, but I do not like pompous anniversaries with a lot of words... I know there is often much hypocrisy and even those for whom the celebrations are arranged often remain unaware of it...

August 14, 1969, to S.Ya. Plotkin

I have been offered a job of teaching at an institute: a large apartment, a high salary, and an important *position. I however turned it down. There I would not be able either to serve science or to train young scientists, which is so essential for me.*

October 2, 1969, to S.Ya. Plotkin

If there were at least thirty six hours a day, instead of the twenty four, I would somehow be able to get through all my many administrative duties and, together with my colleagues, many of whom are science enthusiasts, would be able to "move mountains".

November 6, 1969, to S.Ya. Plotkin

I would like to tell you of my attempts to establish a direct relation between the electronic structure and the various properties of solid and liquid bodies.

January 3, 1970, to S.Ya. Plotkin

I must tell you that as a man of science I experience not only a joy of discovery, but also bitterness and dissatisfaction. Why? Because there is much that remains unknown or unsolved, and there is not much life left to live...

January 16, 1970, to S.Ya. Plotkin

...Sometimes I seem to be aloof from many things unrelated to science, for scientific work and the joy of seeking and finding the truth and of helping someone with something are my greatest delights.

January 1970, to D. Duzhevich

Thank you very much for your kind offer to name me as a joint author of this article, but I cannot accept it, as I only made some critical remarks and some corrections according to the duty of any editor... Please do not take it amiss; it is a good article and I refuse to be named only because I have not taken an active part in its creation...

March 12, 1970, to S.Ya. Plotkin

When we analyze science closely, we perceive that there are always elements of artistic nature in it. They are almost imperceptive but, nonetheless, they serve to stimulate, influence, and aid scientific researches. I have read about the hobbies of Plank and this has strengthened my convictions. The book by Professor B.G. Kuznietsov from your institute asserts my point as well, when he writes how the great Albert (Einstein) appreciated the great Fiodor (Dostoyevskii). I remember you once told me of how Ya.I. Frenkel loved the violin and painting... There are so many similar examples! It would be interesting to collect all such facts and to study the lives of such scientists. This may prove to be a fascinating reading! I think your institute is a perfect place to start researching into such lines.

March 16, 1970, to S.Ya. Plotkin

I would like to select capable and hard working students who express a fervent desire for scientific research. They must, first and foremost, be taught to think, read, write, experimentize, and analyze; they should not be overtly fussed over but should be left to tackle their difficulties themselves as far as possible. That is the only way to train them as scientists and not mere as laboratory assistants.

March 19, 1970, to S.Ya. Plotkin
I like having to invest additional effort when an undertaking fails to succeed. I feel a challenge in combating obstacles. The only thing I cannot tolerate is when difficulties are made artificially, from outside, regardless of the reasons.

June 24, 1970, to S.Ya. Plotkin
Science for me is always a kind of relaxation. Administrative duties tire me. I do not want to become a theatrical administrator but an actor for people. I can hardly wait for holidays when I am able to devote more time to science.

August 5, 1970, to S.Ya. Plotkin
I am full of impressions about Yugoslavia... I can say I have never met such hospitality and expressions of friendship, although my foreign colleagues always receive me very cordially as a scientist... I am glad of meeting Prof. Ristich. He is a man of great initiative with many interesting ideas, compatible with my own scientific plans. Besides, he is a wonderful man, a true intellectual, who loves and knows poetry (including Yesenin)... I hope organize successful joint cooperation with him.

October 1970, to S.Ya. Plotkin
I have been rather unwell lately. I feel a chronic tiredness and would like to unburden myself of my administrative duties as soon as possible so that I could give more time to science and write more.

December 6, 1970, to S.Ya. Plotkin
I still feel weak; perhaps it's the flu or cancer, or a heart condition leading to infarction. Oh, perhaps the whole lot together. My head feels wooly and I have become very mean; only my appetite remains unabated, confound it!"

February 9, 1971, to S.Ya. Plotkin
I am working despite having severe pains in my heart, which is still working too. ...Kuchynskyi and me are a living image of Einstein's formula $E = mc^2$: the product of his velocity and my own mass gives a great energy.

February 18, 1971, to S.Ya. Plotkin
...I cannot exist without experimenting, without daily success and failure, without active work in my fields...

I have spent some days at home, pondering over my theories. During that time I have become aware of many things. Now, I am active again. I will have to travel and perhaps upset relations with the administration and my colleagues. But, I hope that it will all lead to the promotion of research... At times, though, everything seems to run smoothly, without argument or controversy, as if there was nothing left but to celebrate sixty and seventy anniversary jubilees...

March 10, 1971, to S.Ya. Plotkin
Everything here is as usual: work, work, work, and my heart is giving me trouble, damn it.

February 6, 1972, to V.N. Gurin

...May I ask you a favor? The matter is that "Lenizdat" issued the book "Feat before the execution" by S.M. Serpokryl. It is of great interest for my family as it tells about Kibalchych, and my wife is his descendent. Would you be so kind as to find the book, buy, and send me?

April 4, 1972, to S.Ya. Plotkin

I am overloaded with interesting work of the utmost urgency and have great difficulty in finding enough time for other additional work... I am well able to work at anything creative but find it decidedly more difficult to meet the imposed current duties...

...The day before yesterday I presented a rather lengthy report to the Presidium of the Soviet Academy of Sciences on novel materials for tools. This is a very interesting subject: new samples, new hard alloys, and new coatings. I think the report provoked considerable interest. What we need is to express global ideas more boldly... As soon as I am able to, I will take steps in this direction...

May 6, 1972, to S.Ya. Plotkin

I feel very disconsolate: my darling dog, a true friend and companion, Kliaksa, died. I am missing her sorely as we have been inseparable for fifteen years. I talked to her and walked with her, and now she is gone."

...You and I write to each other like Balzac to Countess Hanska. I enjoy receiving your letters and talking to you, having discussions, and exchanging ideas, since, in fact, I am a very lonely man. Talking to you through our letters makes it easier for me to bear my loneliness...

July 16 1972, to S.Ya. Plotkin

I am extremely tired; my health has obviously quite deteriorated. Luckily, the holidays have almost started. I am not going anywhere, not even to our summer cottage. I will stay at home like at a municipal pioneer camp. There are many new books and journals to read. I love my freedom and I am always terrified when I have to stand in line at a ticket office. I want to give my heart a rest from regular service and all kinds of discipline, which, I am sure, is also imposed in rest homes and sanatoriums where I have, mercifully, never been to.

August 21, 1972, to S.Ya. Plotkin

I am a fervent believer in spending summer in summer cottages with mushrooms and forests, strawberries, and tea in the evening; to wait with feverish anticipation for the local news stands to open and for the local "milkmaid" to start on her ice-cream rounds... Unfortunately, all that has passed and I have regained my winter headquarters in Kyiv, and will continue to be a biblical martyr until next summer...

September 8, 1972, to S.Ya. Plotkin

I now understand what they mean when they say "to be alone with nature". I like to take long strolls alone. When one is alone, he sees better, notices more things, and can concentrate and think deeply. You remember how I used to roam about Paris... What a wonderful chance is to be on the Dnipro at sunset or at night!

February 1973, to D. Duzhevich
...as regards my "phenomenal" scientific productivity, there is nothing phenomenal about it. I just have detailed research plans and try to work hard with no respite and waste of time, for science demands one's full engagement. In any case, I cannot even relax without science, and peaceful work at home is the best relaxation for me.

February 11, 1973, to S.Ya. Plotkin
I have no particular news; everything is more or less the same. We are waiting for the new director of the Institute to arrive... At the moment I am the head of the "provisional government" and am waiting for March, 15, for the masses to turn me out of the Winter Palace to Sviatoshyn. I am preparing my disguise of woman's clothes for my escape, after which I will be able to write my memoirs...

April 16, 1973, to V.N. Gurin
I work as usual, according to the principle "Labor transforms monkey into man". Well, I do my best to transform into homo sapience. Everybody has agreed on my transforming into "homo", but when I want to become "sapience", I acquire enemies. But my inherent optimism and memory of Giordano Bruno, burned in fire for his ideas, make it possible to overcome current inquisition. I send you a reprint of my new work, which I myself like (a rare case). It contains a seditious dialectic idea. By the way, I have noticed that my opponents hate dialectics and the second law of thermodynamics; the rest satisfies them.

September 8, 1973, to S.Ya. Plotkin
I send you a list of conferences dealing with powder metallurgy and materials science. Perhaps it will be of use to you. They all serve a good purpose, of course, but meetings and sessions, scientific or unscientific, anti-scientific or pseudo-scientific, at scientific institutions have become too frequent and too numerous and are convened for the glorification of the leadership, the overthrow of heretics and self-admiration. I wonder what have led up to them. Maybe, the distribution of caves? Or the formation of gourmet societies for devouring mammoth meat? Can one fight against such evil or is it worse than cybernetics, or a tram without a conductor, or a supermarket, or "Neva" gillettes? All right, I have bored you enough with questions that mankind has not yet been able to solve.

September 24, 1973, to S.Ya. Plotkin
I write you regularly and frequently, but the post seems to make fun with us. Recently I read that a letter sent from Paris in 1908 arrived in Canada nowadays. So, maybe, sometime in the next century my letters to you will be mentioned in the newspapers as a curiosity.

October 18, 1973, to S.Ya. Plotkin
...I am reading a book on determinism. There are many sensible conceptions but also much that could be contested. I will visit you so that we could discuss matters. It is very difficult to do this via letters and it takes up too much time. Unfortunately, a great surge in the development of current science has led to a great deal of repetition, and many ideas are presented as novel ones without ever making a retrospective study by referring back to

the history of science. This seems to have led us to a great deal of sensationalism, from which many academic titles have been bestowed if they place them in the focus of attention. There are altogether too many bureaucrats in science and, generally, we have become witnesses to the emergence of "His Highness – the Scientific Bourgeois", ready to fight to the death to retain its position in the hierarchy of science and society.

January 24, 1974, to S.Ya. Plotkin
I have petty business to attend to and serious tasks ahead. Sometimes I think if I could relive my life I would live it differently, but a moment later I am sure it would be just the same as it is now... I like both the rainy and sunny weather and feel joyful of the rain turning to sun. Generally, everything is in permanent contradiction, infinite contrasts and diversity, just as mankind has known for the past 2.8 million years.

January 25, 1974 to S.Ya. Plotkin
My most important theoretical work was just published in New York. I think I have written you about it. Now we have to sit tight. But I believe in my ideas and I am ready to defend them even if I have to be "burned at the stake of the scientific inquisition".

March 21, 1974, to S.Ya. Plotkin
One of my greatest pleasures in life is to sit up late at night immersed in a good book at absolute silence. I am reading Thomas More at the moment, his epigrams and the history of Richard III. The more I read, the more astounded I become with the human baseness, envy, and greediness. There is something awry in humans, a fault of nature...

March 28, 1974, to D. Duzhevich
...I am very glad that you have turned your attention to the idea of combining hardness and plasticity. As regards practical aspects, we must always seek to produce homogeneous materials for cutting tools which can combine these two qualities. Only because we currently cannot yet produce such a material, we resort to composite, reinforced, laminated, and other specific materials. All of them are the result of our scientific deficiency, our ignorance, or inadequate knowledge.

April 14, 1974, to S.Ya. Plotkin
...I will gladly come to visit you on Pavlov Street, the famous street that has entered into the annals of Central and Eastern Europe, so that, covered with the mantles of Sherlock Holmes and Romain Rolland, sitting in front of a comfortable fire, smoking colonial tobacco and drinking Dickensian grog, we could talk leisurely of the past, present, and future while studying rare writings discovered by archaeologists...

April 18, 1974, to S.Ya. Plotkin
I have a very sharp tongue, I am afraid. I remember how Voltaire ended up with the wrong end of stick. But I still feel inclined toward taking a snap at the leadership. I think Voltaire was offered the post of director but declined it because he did not want to part with the sarcastic smiles that surrounded him daily.

September 16, 1974, to S.Ya. Plotkin
"I spent a very enjoyable summer at a summer cottage with Nikolai. We browsed around a lot and I feel much better now."

November 3, 1974, to S.Ya. Plotkin
My grandchildren, Kolia and Olia, are growing daily. Olia will be five months in December. She is already a big girl and loves his brother, and he does her. Children are a great handful, of course, but they are lively and funny. I wish I had more time for them, but I have the institute, my teaching, the department, the People's University, the encyclopedia, the philosophy seminar, various scientific gatherings and debates, my vast correspondence, books, and articles. In general, however, it is not too bad.

November 24, 1974, to S.Ya. Plotkin
My grandchildren are growing but I have little time for them, although I adore being with them. They both have very decisive nature. Perhaps they will be able to replace me as a Don Quixote in materials science...

December 8, 1974, to S.Ya. Plotkin
I am unwell; my blood pressure is high. I feel as if I was definitely going to kick the bucket with all my free ideas and continue my service in the form of a corpse. As you can see, I am having dark thoughts which ought to be dispelled...

December 20, 1074, to S.Ya. Plotkin
It is almost New Year. What will it bring us? This year has not been easy and happy. On the whole, it is a frivolous and meaningless year. I have accomplished certain things but, sorry to say, very little. I have got interesting plans for the coming year and would like to raise my scientific productivity if only my health permits me this.

January 16, 1975, to S.Ya. Plotkin
I find it impossible to reconcile myself to Grigorii Abramovich's (Meyerson) sudden death. He represented a great deal to me; he was my first teacher and a friend. I owe him a lot for my professional life and I was always impressed by his talent and the fact that he gave much to our science and production, for he was the first Soviet teacher of Soviet scientists dealing with powder metallurgy.

February 2, 1975, to S.Ya. Plotkin
I am very pleased that the meeting of the group dealing with the history of metallurgy passed in a normal atmosphere; the discussion was interesting and the discussants were all highly skilled and able men, passionately drawn to their studies... This might sound strange to you but I think there is something very poetic and romantic in the history of science, a quality that is often sorely lacking today... When you come across such romanticism, it fills you with a feeling of great pleasure. But for me, it serves a practical purpose as well. I immediately turn to realism and begin to make notes of what can be taken over from the old and half-forgotten theories and put to practical use today. I have learnt much from the meeting. Perhaps, most of all, I get aware that much to do with science of materials has come from antiquity or the Middle Ages, and I am sure we are on the right road to progress.

February 22, 1975, to S.Ya. Plotkin
Thank you for the birthday wishes. Sorry to say, years are running away and there is much more left to do than already done, and this gap is increasing. Nothing to be done.

...I am not against meeting with Regel, but, in general, I cannot stand higher-ups and introductions to them, because there is nothing to talk about. The only desire is to escape to common people.

IPMS is working, KPI is spoiling the new generation, and the graduates are absorbing great ideas...

February 24, 1975, to S.Ya. Plotkin

Life goes on as usual. Kyiv has been standing still since the IX^{th} century. Nothing seems to have changed, and one almost expects Prince Ihor to step out from around the corner or Prince Volodymyr to push his people into the Dnipro in order to baptize them. Or more else, one may expect to come across Bulgakov, Paustovskii, or Erenburg in the courtyard...

I love Kyiv but my heart is in Moscow though it is a "young girl" compared to the mature beauty of Kyiv.

May 11, 1975 to V.N. Gurin

...Two months ago I made a report at the Presidium of AS USSR on our works, which met a vivid and interesting discussion ended with the conclusion that today there is no hope for a high fundamental theory, hence we should develop various models and firmly rely on experiment. This report will be published in "Vestnik of AS USSR"... I think the most important result is that I have attracted the attention of our higher-ups to this problem. 1 would like to be engaged in it much deeper but I need more time and more talented associates to get required results. All the same, I will continue this work as the problem is very important.

May 18, 1975, to S.Ya. Plotkin

I feel awful. As a born optimist that I am, I live expecting for the better and being impatient for the holidays to start, so that I could retreat to my beloved cottage and immerse myself in a provincial, small-town life, where, astonishingly, something old, familiar, and dear has survived and where there is nothing atomic-rocket-like or cybernetic. I have not travelled much, I have had neither time nor inclination. Quite evidently, the force of gravity pools me down toward one spot (the next step will be my penetration into the ground).

May 27 1975, to S.Ya. Plotkin

...You are in the capital; but here, in this princedom of ours, our boyars don't seem to understand the benefits of going to the Adriatic. You cannot write anything because there is nothing to write with; there are no quills. Nonetheless, I am having a caftan and shoes of saffian, and I am collecting rubles for beer and honey... I am often reminded of your Institute: the towers and the boyars, the courtiers and the stolniks who ruled with such ferocity through history, and the officials who wrote out orders in Edinburg (where the 1977 International Congress on the History of Science is to be held); the Scots wear skirts (which they call kilts) and sun frocks, and I suppose their women wear pants. Poor, unfortunate souls...

August 10, 1975, to S.Ya. Plotkin

...I am spending my time at our cottage walking with my grandchildren and absorbing a quaint little township. I must confess that it is a secret passion of mine to walk around old towns with their local intelligence and well-kept gardens of old style, their market places and local photographers, the railway station, and the board of honor in memory of the town's past dignitaries. I teach my grandson to have a sense of humor and to think intelligently. This is rather difficult for one who is not sure that intelligence is now more preferable to being as a youngster...

At present, I rest a little and then work a little. I go for nearby walks and meditate."

August 29, 1975, to S.Ya. Plotkin

I came up from the country yesterday and I am about to begin active work... Officially, I am to start working on September 1st and now I am polishing drums and blowing horns; my sandals have been freshly gilded and I am mending my toga — what else does a petty provincial need for work in a department as an emperor in his empire of refractory materials?...

September 24, 1975, to V.M.Gropyanov

I received your letter and thought over it for a long time. I have come to the conclusion that we comprehend the book on electronic chemistry differently... You are right that each item should start from a chapter dealing with description of the electronic structure (detailed enough for students) according to the configuration model of matter and the papers published in the Ukrainian Chemistry Journal... If it is inconvenient for you to come to Kyiv, I am going to visit Leningrad in October and then we'll arrange the things. I send you a couple of articles which may be useful for you.

October 21, 1975, to S.Ya. Plotkin

They have not reached a clear definite diagnosis. The extensive discussions held at the highest scientific level have concluded that I am suffering from gall bladder and intestinal mulfunctions, chronic bronchitis, irregular functioning of lymphatic glands, stenocardia, a disease caused by radiation, and even from cancer. I think I could add plague and cholera to the list, not to mention all the minor ailments such as typhus, smallpox, and the like. Thus I have not yet known what I am suffering from, but examinations are going on with a renewed force. I have become a guinea-pig for experiments that will, no doubt, find their place in somebody's scientific dissertation. All the same, I keep thinking of how I will be let out for at least one or two months and regain my freedom, and return to those waiting for me. I am very sorry I was not able to go to Zakopane.

November 25, 1975 to D. Duzhevich

...I was very glad of receiving your letter. Thank you so much for your good wishes and sympathy with my disease. As you can see, even a very strong man like me may become unbalanced, just like stable configurations, even the configurations of inert gases. However, my reaction activity is far greater and my valence electrons are exited. Well, this is just a joke; in fact, I am trying to recover and hope to be at home by New Year.

P.S. I must apologize for my bad handwriting, but I still find it a little difficult to write.

December 15, 1975 to R.A. Andriyevskyi

The day I received your letter was very bad for me. Fortunately, somehow my condition and mood have changed for the better. Thank you for the letter, thank you very much. I experience terrible weakness, the right hand does not work, complete aversion to food, dizziness. X-ray irradiation has provoked all this, the doctors have overdone. Still, I hope for the better.

Thanks again for all, dear friend.

December 21, 1975 (on the eve of death), to S.Ya. Plotkin

I continued to work in the hospital but found it boring without the Institute and active work. My only hope is that I'll pull through.

DATES OF G.V. SAMSONOV'S LIFE

Grigorii Valentinovich Samsonov was born on February 15, 1918 in the city of Pushkin near Saint-Petersburg.

1935	Finished secondary school in Moscow
1935—1940	Student of M. Lomonosov Moscow Institute of Fine Chemical Technology
1938—1939	Engineer of Moscow Institute of Hard Alloys
1940	Engineer-researcher at GSPI-7 of Commissariat of Armament of the USSR
1941—1944	Soldier, junior commander, officer of the Soviet Army on the fronts of World War II
1944—1945	Student of Military Institute of Foreign Languages of the Soviet Army
1945—1947	Employee of the Soviet section of the Allied Commission for Austria
1947—1950	Graduate student at Moscow Institute of Nonferrous Metals and Gold
1950—1956	Senior researcher, associate professor of the Department of Metallurgy of Rare Metals at Institute of Non-Ferrous Metals and Gold
1951	Defense of candidate dissertation
1956—1975	Head of the department of refractory compounds at IPMS. Deputy Director of IPMS for Scientific Work
1957	Defense of doctoral dissertation
1959	Approved in the rank of Professor
1960	Elected Corresponding Member of AS of the Ukrainian SSR
1961—1963	Head of the Department of Physical and Technical Problems of Materials Science at AS of the Ukrainian SSR
1963—1974	Head of the Department of High Temperature Materials and Powder Metallurgy at KPI

G.V.Samsonov was recognized by the following awards of distinction:

Medal "For Military Merit" (1944)
Medal "For Victory over Germany" (1945)
Order of the Red Banner of Labor (1961)
Title of Honorary Worker of Science and Technology of the Ukrainian SSR (1968)
International Plansee Medal for work in the field of powder metallurgy and metal physics (1969)
State Prize of the Ukrainian SSR in the field of science and technology (1969)
Medal "For Valiant Labor" (1970)
Order of the Badge of Honor (1971)
Ye.O. Paton Prize (1972)
S.I. Vavilov Medal for propagating scientific knowledge (1973)

Grigorii Valentinovich Samsonov died on December 22, 1975. He was buried at the Baikove cemetery in Kyiv.

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CONTENTS

SCIENTIST

ORGANIZER

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Книгу присвячено пам'яті відомого вченого, талановитого організатора, лауреата державних та іменних наукових премій, члена-кореспондента Національної академії наук України Григорія Валентиновича Самсонова.

У спогадах його учнів, колег і друзів показана неоціненна роль Г.В. Самсонова у розробці основ матеріалознавства тугоплавких сполук та створенні відповідної могутньої школи, яка плідно працює й нині.

Для фахівців у галузі матеріалознавства та розробки нових перспективних матеріалів, а також усіх, хто цікавиться історією вітчизняної науки та діяльністю її яскравих представників.

Наукове видання

НАЦІОНАЛЬНА АКАДЕМІЯ НАУК УКРАЇНИ
ІНСТИТУТ ПРОБЛЕМ МАТЕРІАЛОЗНАВСТВА
ім. І.М. ФРАНЦЕВИЧА

УЧЕНИЙ ОРГАНІЗАТОР УЧИТЕЛЬ

Спогади про Г.В. Самсонова

Англійською мовою

Видається в авторській редакції

Художнє оформлення *Є.О. Ільницького, П.О. Ярмоли*
Технічний редактор *Т.М. Шендерович*
Комп'ютерна верстка *В.Г. Веденської*

Підписано до друку 23.03.2018. Формат 70 × 100/16.
Гарн. NewtonC. Ум. друк. арк. 12,84.
Обл.-вид. арк. 14,68. Тираж 300 прим. Зам. № 5204

Видавець і виготовлювач
Видавничий дім «Академперіодика» НАН України
01004, Київ, вул. Терещенківська, 4

Свідоцтво про внесення до Державного реєстру суб'єктів видавничої справи серії ДК № 544 від 27.07.2001