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PERSONALIA

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In memory of Vyacheslav Vasil'evich Osiko

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Academician of the Russian Academy of Sciences (RAS), outstanding physico-chemist, Russian science coordinator and brilliant representative of the Russian school of experimental physics and physical materials science, Vyacheslav Vasil'evich Osiko, passed away on November 15, 2019 at the age of 87. The main areas of scientific activity of V V Osiko were solid state physics and chemistry, laser physics, materials science, and nanotechnologies. Vyacheslav Vasil'evich laid the physical and technological bases of optical materials sciences, which paved the way for new branches of science and technology.

V V Osiko was born on March 28, 1932 in Leningrad. In 1954, he graduated from the Faculty of chemical Engineering of the Mendeleev Moscow Institute of Chemical Technology and, on assignment, began working at the Laboratory of Luminescence at the Lebedev Physical Institute (LPI) of the USSR Academy of Sciences. From 1955 till 1960, V V Osiko took part in the search for, obtention of, and investigation of inorganic photo- and cathode-luminophors performed under the guidance of M A Konstantinova-Shlezinger. In 1960, he defended his Cand. Sc. thesis.

In 1961, the first synthetic ruby crystal laser began operating. At exactly that moment, the Nobel Prize winners A M Prokhorov and N G Basov charged the young scientist V V Osiko with organizing a new subdivision at LPI — the Department of Single Crystals — with the task of creating the 'heart' of solid-state lasers, active elements based on crystalline and glassy laser materials. The young candidate of sciences headed the Department of Single Crystals at LPI and became engaged in the search for, obtention of, and investigation of materials for the new field of science and technology — laser physics. Everything had to be done from scratch: selecting staff, designing equipment, and working out the technology and methods for investigating materials. At first, the department was called scientific-productive, with the task of only serving the needs of fundamental science. In 1968, the subdivision was included in LPI's Laboratory of Oscillations headed by A M Prokhorov. In 1983, after the General Physics (GPI) Institute of the USSR Academy of Sciences was formed, the subdivision became the GPI Department of Solid State Physics. At the present time, it is the world-renowned Research Center of Laser Materials and Technologies of the Prokhorov General Physics Institute of RAS.

By the late 1960s-early 1970s, about a quarter of all known laser materials had been synthesized under the research leadership and with the direct participation of V V Osiko. They underlay new types of solid-state lasers with unique characteristics. High-power continuous lasers (the most powerful solid-state lasers in the world for many years) were created at LPI's Laboratory of Oscillations on the basis of new fluorite crystals with dysprosium and cerium. For this purpose, the technology of fluoride crystals was developed, including complex ones with a disordered structure and activated by rare-earth elements in trivalent and bivalent states. An active fluorinating atmosphere of teflon pyrolysis products was proposed to use to grow fluorides. This technology, widespread and developed in our country and abroad, allows growing laser crystals with extremely low optical losses.

V V Osiko's studies on the melting and crystallization of refractory dielectrics through direct induction heating in a cold container are known around the world. The new method allowed rejecting the use of precious metals as materials for crucibles, because the crucible was then a thin crust of the melted substance itself — a scull which, in addition, does not pollute the melt at all. This method was used to obtain zirconium and hafnium cubic oxide crystals, which have no

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equivalent in nature and are called 'fianits', after FIAN, the Russian abbreviation for LPI. The crystals spread within a short time and are now the second most produced single crystal by volume in the world, after silicon single crystals. For these studies, V V Osiko was awarded the Lenin Prize (1980).

In the 1970s–1980s, V V Osiko's research was devoted to establishing and developing a new avenue of laser material science — so-called high-concentration crystals and glasses, in which the active ion concentration in the cation sublattice ranges from several tens to one hundred percent. The first in the series of such crystals was an yttrium-erbium garnet. This crystal was the basis for several types of effective lasers operating at the wavelength of ~ 3 μm, widely used in medicine.

A whole number of materials recognized and widely applied around the world were created. A series of tunable lasers and spectrometers based on lithium fluoride with color centers operating at room temperature and overlapping the visible and near-IR spectral regions was worked out. This equipment now operates successfully in many laboratories in Russia and abroad.

The technology of nanostructured fluoride optical (including laser) ceramics was elaborated under the guidance and with the personal participation of V V Osiko. Its optical, spectroscopic, and laser characteristics correspond to single crystals, but surpass them considerably in mechanical strength. Obtaining fluoride ceramics opened the prospect of creating optical devices, scintillators, and a new generation of lasers.

On the basis of direct high-frequency heating in a cold container, the method proposed by V V Osiko earlier — the experimental-production technology of synthesizing high-strength, wear-resistant nanostructured crystals — was created. The technology of mechanical processing of new crystals was proposed and an experimental set of products for tribotechnical and medical use was fabricated. Produced was a series of 'Plasmatom' electrosurgical devices with instruments based on crystalline nanostructured, partially stabilized, zirconium dioxide, including bipolar electrosurgical scissors, clippers, and scalpels. The devices are copyrighted, certified, and being used in medical surgically-oriented institutions.

In recent years, Vyacheslav Vasil'evich took an active part in the development of the conception of non-classical crystal growth via directed nanoparticle agglomeration.

It is difficult to unambiguously place the scientific achievements of Vyacheslav Vasil'evich in a single sphere of knowledge. In the 1960s, he defended his thesis as a in Cand. Sci. chemistry. In 1968, he became a Dr. Sci. in Phys. and Math., in 1972 became a professor, in 1981 was elected a corresponding member of the USSR Academy of Sciences of the Division of Chemistry and Material Science, and in 1987 was elected a full member of the USSR Academy of Sciences, Division of Physics and Astronomy for his achievements in the field of experimental physics. The conclusion suggests itself that outstanding results in a narrow area of scientific research are only attainable on the basis of deep fundamental knowledge and experience in a wide spectrum of science, including several branches.

Vyacheslav Vasil'evich was a positive man, paying special attention to young researchers and science novices. He trained more than 20 candidates of sciences and eight doctors of sciences. Among his disciples is an academician and a corresponding member of the RAS. Vyacheslav Vasil'evich was one of the supervisors of the educational research center of GPI RAS — Moscow University of Chemical Technology . He took an active part in the work of the joint laboratory of GPI RAS and Mordovia State University. In the laboratories of the Research Center, students and postgraduates from many physics, engineering, and chemistry educational institutions from Moscow and elsewhere carry out graduation work and master's and doctoral theses.

During the years of his scientific activity, V V Osiko published about 500 original papers and reviews and received 40 authorship certificates and 15 patents. Both alone and in co-authorship with colleagues, he wrote chapters in thematic scientific collections of leading foreign publishers, issued a number of monographs, including *Fianits* (Moscow: Nauka, 2001), *Laser materials. Selected works* (Moscow: Nauka, 2002), and *Refractible materials from a cold crucible* (Moscow: Nauka, 2004). The latter two monographs were translated and published by scientific publishing companies in China.

Along with heading the Research Center, V V Osiko also did much other scientific and organizational work: he was chair of the RAS Committee in charge of selecting inventions for patenting abroad, a co-chair of the RAS — Samsung Committee, and, for several years the head of the Federal Laser Physics Program.

Official recognition of V V Osiko's merits was his being awarded the Order of the Red Banner of Labor (1974), the Order of Honor (2002), and the Order of Friendship (2013). He received the Lenin Prize (1980), the Council of Ministers Prize (1991), the Laudise Prize of the International Organization for Crystal Growth (1992), the E S Fedorov Prize (2003) for a series of studies on high-temperature crystallization, and the A M Prokhorov Gold Medal of RAS (2018).

One cannot but mention the personal qualities of Vyacheslav Vasil'evich. Those acquainted with him knew that he addressed people or spoke about people using their name and patronymic, with the exception of his close friends, whom he called by name only. Service to science prevailed over personal convenience. In the old building of the Institute of Acoustics where the department came into being, Vyacheslav Vasil'evich's desk was situated in a small passageway room. And when, in the early 1970s, new equipment — a Komebaks scanning microscope — appeared the desk was moved to the hall and was located between optical tables on which laser models crackled and sparkled and vacuum pumps buzzed. But at the beginning of the 1980s, the optical setups became too closely spaced, and the desk found itself in a room between two crystal growth setups. At this desk, Vyacheslav Vasil'evich worked on his own articles and reports and edited publications of his colleagues, paying serious attention not only to the subject matter but also to the style of the language. This also concerned papers of which he was not a co-author. Vyacheslav Vasil'evich was surprisingly skillful in resolving interpersonal conflicts, inevitable in a large team of colleagues not devoid of ambitions, and he never raised his voice in the slightest. The appearance of a new department of nanotechnologies at the Research Center was not only the consequence of the development of science, but also the result of such a solution.

Vyacheslav Vasil'evich not only worked hard, but also knew how to relax. His colleagues recollect heartily the annual September barbecues at his dacha near Korolev — Proletarskaya 23. Old LPI workers remember Slava Osiko as

a hot-tempered table-tennis player and a frequent table-tennis champion of LPI. From the early 1960s, Vyacheslav Vasil'evich was a member of the RAS Central House of Scientists and then a member of the Council of the Central House of Scientists. And in the difficult 1990s, he defended actively the Central House of Scientists from the trespasses of commercial structures.

Those who knew Vyacheslav Vasil'evich will long remember him as a talented scientist and skilled leader, teacher, and Man.

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