Summary.

From 1974 to 1976 he studied and successfully graduated from Physics and Mathematics School No. 165 at Novosibirsk State University, Novosibirsk.

From 1976 to 1981 he studied at the Faculty of Physics, Department of Low Temperatures, specialization theoretical physicist, Novosibirsk State University, Novosibirsk. The diploma work on superconductivity in layered metals took second place in the All-Union competition of student papers on its topic. While studying at the university, he met the outstanding scientist Patashinsky Alexander Zakharovich, who was carried away by the topic of second-order phase transitions in the condensed phase. Therefore, after graduating from the university in 1981, he was assigned to the Institute of Solid State Chemistry and Mechanochemistry of the Siberian Branch of the USSR Academy of Sciences. The topic of the work was related to the study of the theory of superionic conductivity. After the departure of Patashinsky A.Z. in the United States for a permanent job at the University of Illinois, the topic of work has changed slightly and was associated with the study of the mechanism of movement of atoms in condensed media under various influences.

When studying the mechanism of diffusion of atoms in condensed media, it became clear that progress is possible only with the use of computer simulation. During 1985-1986, a program was developed and debugged to simulate the processes of motion of atoms by the method of molecular dynamics. In 1989 he defended his Ph.D. thesis on the topic “The elementary act of rearrangement of atoms in solids. Analytical calculations and computer modeling”. The main conclusions of the dissertation work: 1) the diffusion rate of atoms depends on the local, but not long-range, order, 2) the diffusion rate of ions in the lattice does not depend on the size of the ion, but on the size / charge ratio, 3) near the melting point in solids begin to appear collective movement of atoms. Modeling the processes occurring in solids under mechanical stress has shed light on some of the effects observed during mechanochemical reactions - chemical processes occurring in mills. It turned out that even with slow compression or shear, some crystal lattice defects move at the speed of sound. This means that the local temperature near the core of the defect reaches ten thousand Kelvin, and in the process of machining we can obtain a metastable (usually amorphous) state of the material, which is not attainable by other methods of exposure. From 1990 to 1993, he conducted seminars on the course "Probability Theory and Mathematical Statistics" at the Faculty of Natural Sciences of Novosibirsk State University.

In 1996, due to the collapse of fundamental science, he moved to Irkutsk and began working as an engineer in the quality control department in the management of highways in the Irkutsk region. He was engaged in laboratory and field testing of bitumen and asphalt concrete. In the process of practical work, together with chemists from Irkutsk State University, he developed an industrial technology (three patents received) for dissolving crumb rubber in bitumen. This

technology differs from most technologies used in different countries in that during processing, rubber is devulcanized and dissolved in bitumen. The obtained bitumen-rubber composite possesses unique adhesion to all stone materials, brittle temperature minus 31°C, softening temperature plus 55°C. To date, an industrial plant for the production of a bitumen-rubber composite has been operating in Bratsk for 10 years. On the basis of a bitumen-rubber composite, cold asphalt concrete has been developed, with the help of which it is possible to repair asphalt concrete pavements at temperatures down to minus 20°C, as well as an adhesive additive to obtain an activated mineral powder based on ash from coal combustion. The activated mineral powder increases the water resistance of the asphalt concrete and improves the compaction process. The industrial production of activated mineral powder in a Chinese-made ball mill was established at an asphalt concrete plant in Shelekhov city , Irkutsk region.

In 2007 he moved to work at the Irkutsk National Technical University as an associate professor at the Department of Highways. In parallel with teaching, he conducted scientific and practical activities on the use of new technologies and materials in road construction. Most of the scientific articles were devoted to the study of asphalt concrete based on bitumen-rubber binder, the study of mixtures of activated powders and bitumen, the production and use of bitumen emulsions. Currently I am engaged in modeling asphalt concrete using a computer program that works according to the method of discrete elements. This program was developed by G.N. Khan. at the Institute of Mining of the Siberian Branch of the Academy of Sciences, Novosibirsk. The method of discrete elements allows one to calculate the physical and mechanical properties of asphalt concrete from first principles: which properties are determined mainly by the binder, and which are the granulometric composition of mineral fillers.

In 2008 and 2009, he published two papers in a prestigious Russian physics journal, which summed up the work on the study of the diffusion mechanism in solids. With the help of computer simulations, it was shown that in any atomic crystal, before melting, collective diffusion should manifest itself, and this is precisely where the main difference between a liquid and a solid is manifested. The presence or absence of long-range order does not greatly affect the mechanism and speed of diffusion processes; this was one of the theses of the dissertation work. For example, in glasses below the glass transition temperature, the mechanism and rate of diffusion are the same as in crystals. The second work demonstrated, using the example of a crystal with a face-centered cubic lattice, that the melting of crystals is not a phase transition, where the loss of long-range order and a jump in the diffusion coefficient occur simultaneously. Before melting, which manifests itself in a jump in internal energy, a soft mode begins to appear in a certain temperature range, which leads to the loss of long-range order, but the material remains solid. When a certain critical disorder is reached, an avalanche-like increase in the collective motions of atoms begins,

which manifests itself in the form of a jump in the diffusion rate and a jump in the internal energy. The melting point is the transition point from single displacements of atoms to collective displacements. Therefore, modern theories of melting based on the solution of the Bogolyubov-Born-Green-Kirkwood-Yvon equations cannot describe the phase transition. Moreover, a qualitative analysis of these equations shows that the transition from order to disorder is not accompanied by a jump in thermodynamic functions. Qualitatively, the theory of melting, which I confirmed in a computer experiment, was constructed and published in the ZhETP journal by A.Z. Patashinsky. around 1990.

Since 2014, in parallel with his work at a technical university, he began cooperation with the production company "Chemical Service" in Irkutsk. I have developed a recipe for a polymer-bitumen emulsion, an analogue of “liquid rubber”, and on the basis of a Chinese emulsion plant, in 2016, industrial production of various mastics was launched. In 2018-19, I developed a recipe for anti-abrasive protective polymer-ceramic compounds, an analogue of the compositions of the American company “Chesterton”. Currently, these compositions are successfully used throughout Russia and in foreign countries to protect pipelines and pumps through which suspensions containing abrasive particles, as well as cement, sand, gravel, grain and other granular materials, move.

A list of scientific papers and patents is attached.

I have interest in practical cooperation and joint publications with Chinese colleagues on the following topics:

1. Investigation of the physical and mechanical characteristics of binders based on bitumen, rubber crumb from used car tires and mineral powder.
2. Modeling of asphalt concrete by the method of discrete elements.
3. Creation of anti-abrasive coatings with increased heat resistance.
4. Creation of hydrophobic and chemically resistant coatings.