

INSTITUTE FOR SUPERHARD MATERIALS NAS UKRAINE

department of "Physico-chemistry and technology of composite abrasive materials. Development and application of tools based on these materials."

WHO WE ARE

In general, our research profile can be defined as chemical materials science. The main experience, goals and objectives of the department related to:

- the development of new heat-resistant and adhesion-active binders, such as a variety of organic and hybrid oligomers, glasses and other activated non-metal powder systems for low temperature sintering, metal powder systems including compositions which are modified by nanoparticles with different physico-chemical nature;
- the creation of composite materials for abrasive tools, anti-friction products, and other components of the various applications, adhesives and coatings;
- the study, analysis and theoretical description of processes mechanisms connected with the synthesis and the working behavior of composites.

Well-qualified researchers: 4 Dr. Sci., 5 Ph.D. and 25 engineers and auxiliary personnel.

At the core of an experimental infrastructure of department - a set of press equipment and furnaces.

We have a variety of tool set, designed for the manufacturing of various abrasive tools. Directly in our department, we investigate the microhardness of composites, we estimate the structure by means of optical microscopy and carry out the thermal analysis of new materials.

COLLABORATION INTEREST

Our department is interested in participating in EU projects under FP8 program and also in other forms of international and projects in the following research areas: mechanisms of the structure formation

during the consolidation of monomers and oligomers; the consolidation of glass and metal powders during the free and compression sintering; the formation of interphase surfaces in filled composites; the formation of precision surfaces of non-metal materials for optics and electronics; mechanisms of functioning and destruction of materials in the dynamic contact zone of solids; abrasive cutting mechanisms; the development of polymers, glassy and metal coatings for various purposes.

Potential role: major partner, scientific expert, technology provider.

RESEARCH AREAS

- The study of physico-chemical mechanisms of the directional formation of the structure and properties of instrumental and functional composites and coatings based on different (polymeric, metal and glass) binders; the investigation of processes of sintering and contact behavior of composites;
- Development of new criteria for the optimization and prediction of the working behavior of binders and composites;
- Functionalization of abrasive and non-abrasive powders surfaces;
- The chemical metallization of powders and polycrystals of superhard materials;
- The synthesis and study of "smart" polymers capable of reversible structural transitions in the zone of friction and abrasive cutting;
- The development of physical principles and methods of forming ultraprecision surfaces using in-situ-control.

MAIN ACHIEVEMENTS

- Developed at quantitative level and experimental described the mechanism of destruction of lattice polymers in the friction zone, based on the account of dilaton spectrum, causing the breaking of bonds in the excited states of substance;
- Obtained composites based on polymers, demonstrating the oscillating kinetics of gas products emission in the abrasive cutting zone.
- Developed abrasive composites which are capable to the adaptive behavior in the work area. Developed technological processes:
- The ultraprecision treatment of semiconductor surfaces and optical materials in conditions of in-situ-control state of treated surface;
- Wear resistant coatings based on Ni, Ti, Co, W with the injection of nanoparticles of refractory materials;
- The manufacturing of abrasive composites of SHM based on low-temperature ceramic binders for the grinding of the hardened steel and titanium melts;
- The coating of glasscoatings on diamond and CBN powders;
- The thermoreactive free sintering of metal-diamond composites.

CONTACT INFORMATION

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Working languages: English, Russian, Ukrainian

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