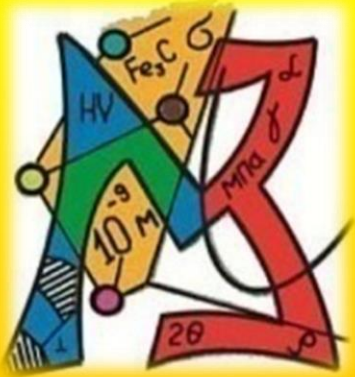


**Proposals for cooperation  
of Materials Science department of  
NTU “KhPI”**

# "Materials Science" of department



Professor, Doctor of physical and mathematical sciences, head of the Department of Materials Science **Sobol' O.V.**

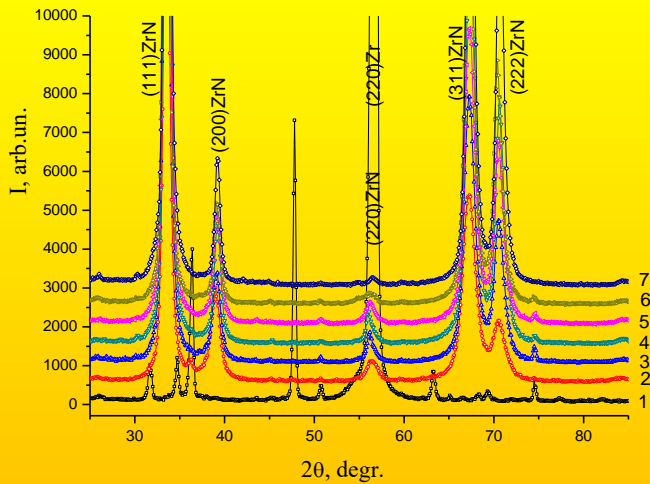
e-mail: [sool@kpi.kharkov.ua](mailto:sool@kpi.kharkov.ua)

## Specialization of the Bachelors and Masters:

- „Applied Materials Science and Computer Engineering of Materials“
- „New functional materials and nanotechnology “

## Subjects research:

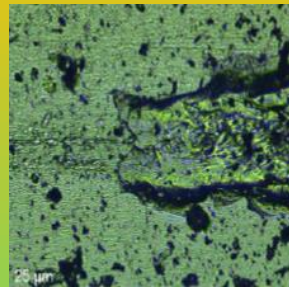
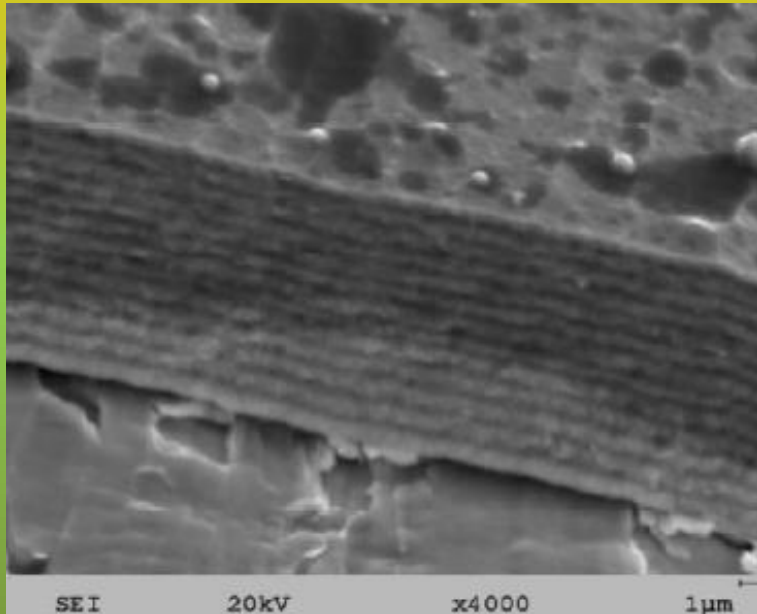
- diffractometers for precise structural studies and tensometry (DRON-4, DRON-3M, DRON-2)
- transmission electron microscopy (TEM)
- microscopes for high-resolution optical analysis and software packages for image processing
- vacuum arc evaporation (both in standard mode and with pulsed stimulation with voltage up to 2 kV and a pulse duration of 20  $\mu$ s);
- magnetron sputtering;
- microarc oxidation (MAO);
- processing high-frequency currents;
- different kinds of thermochemical treatment (boriding, nitriding)
- ion nitriding with pulse stimulation and subsequent application of protective coatings



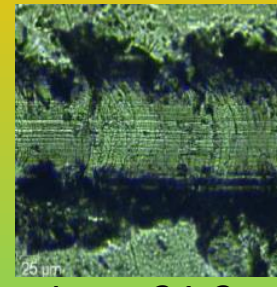
Research the multilayer compositions of single- and multicomponent nitrides of transition metals (including high-entropy alloys  $(\text{TiAlHfVNb})\text{N}$ ,  $(\text{TiAlHfVNb})\text{N}$ ,



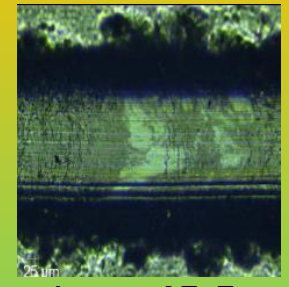
$(\text{TiAlHfVNbTa})\text{N}$ ,  $(\text{FeCoNiNbCrCuV})\text{N}$ ,  $(\text{TiAlCrSiNb})\text{N}$ , with high and ultrahigh hardness. Structural Engineering of steels surfaces (including the formation of S-phase, etc.) by means of ion nitriding, followed by coating nitride or metal coatings.



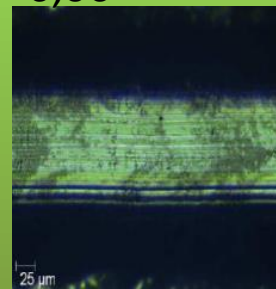
Lc1 = 6,06



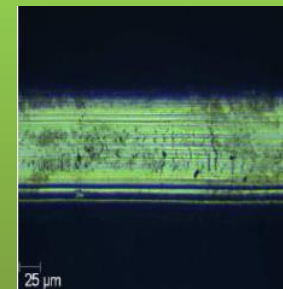
Lc2 = 31.3



Lc3 = 45.5

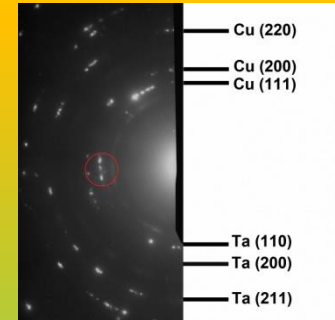
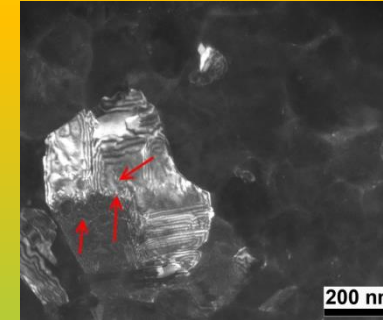
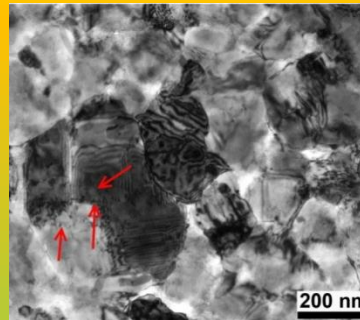
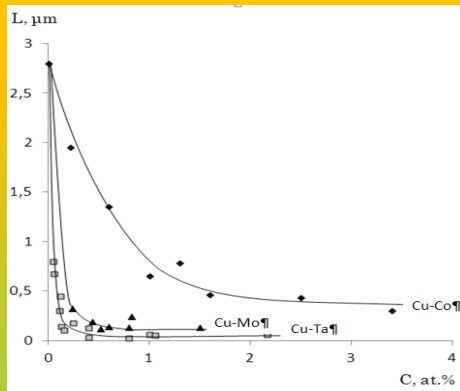
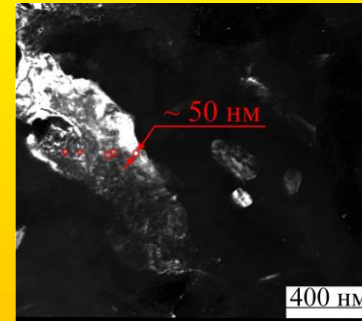
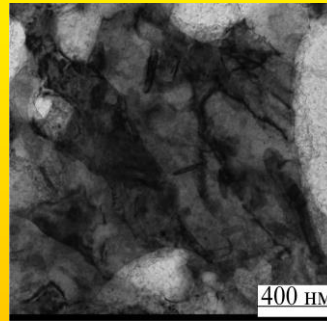
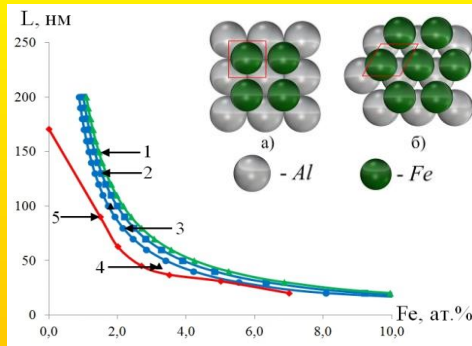


Lc4 = 81.6

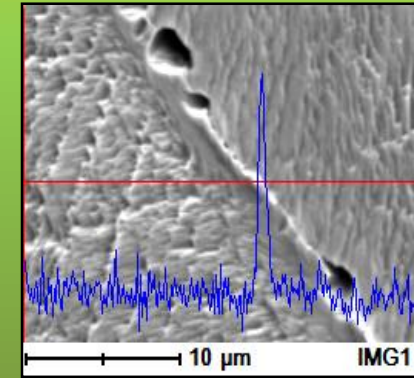
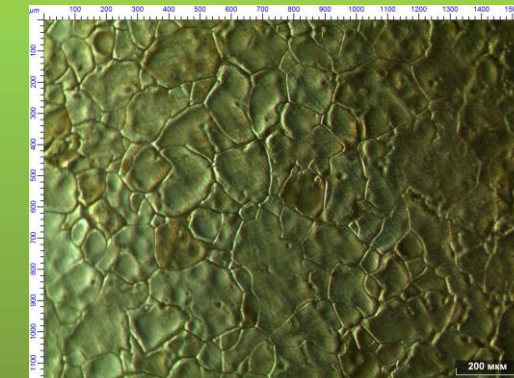
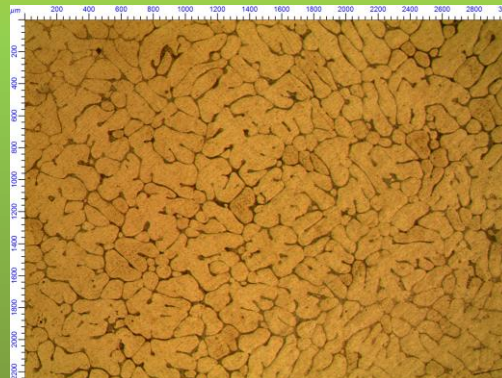


Lc5 = 124.9

# Development of producing technology and studying the structure and properties of nanostructured metals based on copper, iron and aluminum

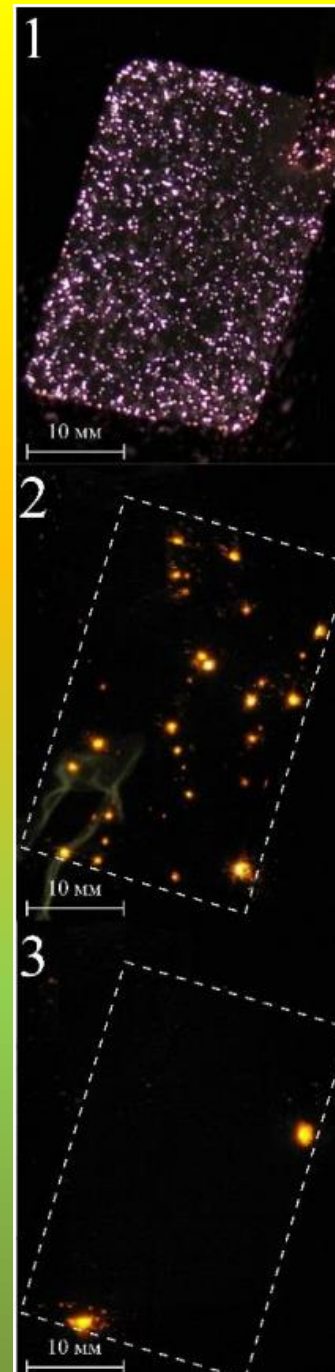
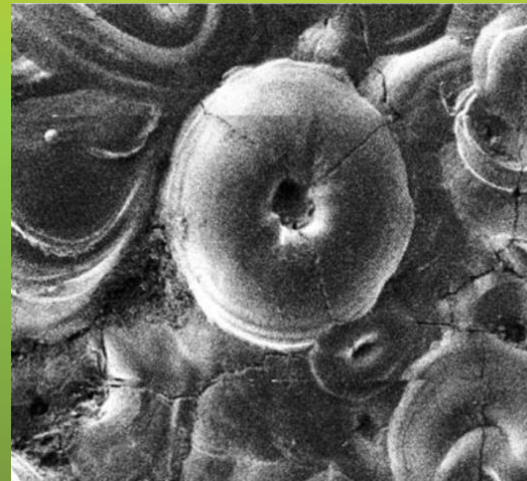
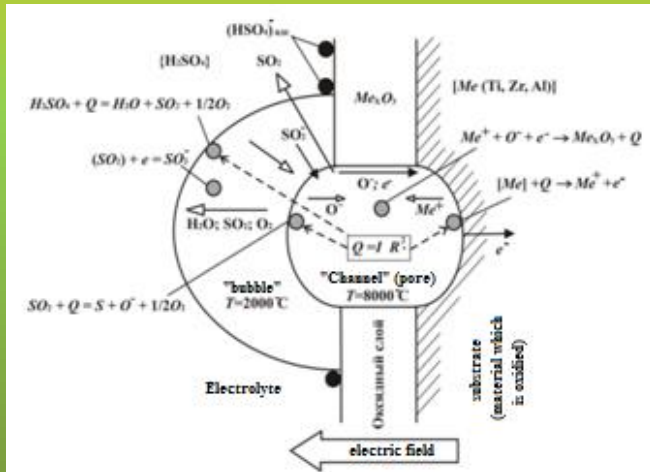


## Vacuum metallurgy



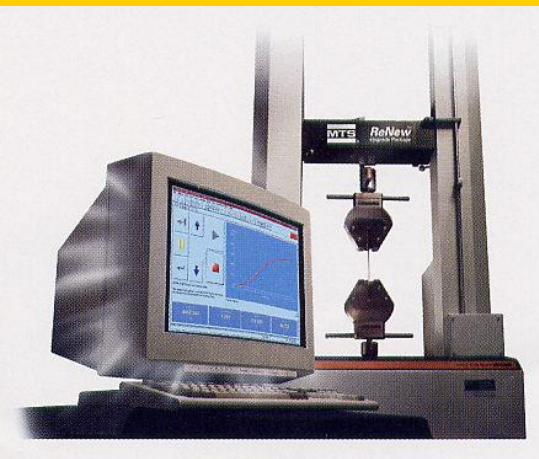


Obtaining and investigation of MAO coatings to improve the effectiveness and expand the range of processed alloy. Appropriation of new electrolytes, selection of optimum modes, new power supply

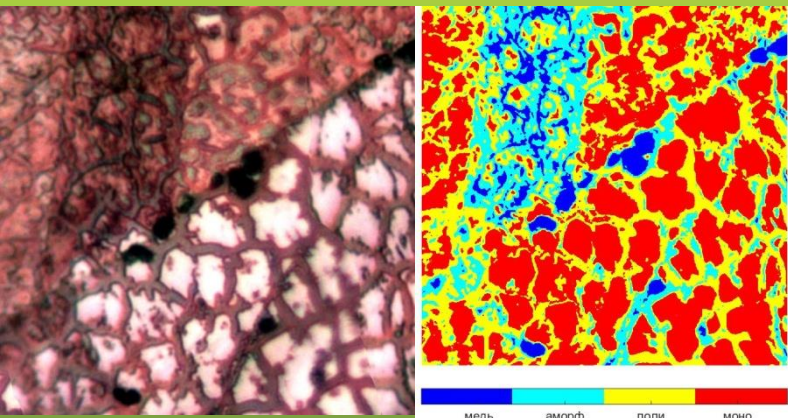
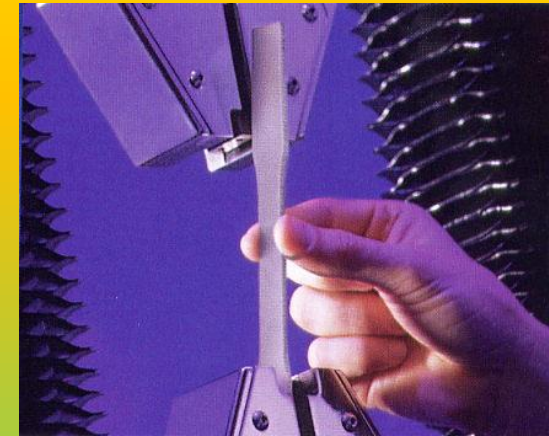




Progressive methods of heat treatment machinery parts and semi-finished products



Strength and plasticity of alloys with duplex structure



Application the computer processing of optical images of the surface in the case of multi threshold intensity sections

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6. O. V. Sobol'. Structure Engineering in Vacuum-Arc-Deposited Coatings of the MoN–CrN System / V. M. Beresneva, O. V. Sobol', A. D. Pogrebnyak, S. S. Grankin, V. A. Stolbovoi, P. V. Turbin, e, A. A. Meilekhov , and M. Yu. Arsenko // Technical Physics Letters. – 2016. - Vol. 42. - Is. 5. - 532–535.
7. O.V. Sobol'. Structural Engineering Vacuum-plasma Coatings Interstitial Phases // Journal of Nano-and Electronic Physics. – 2016. –Vol. 8. - Is. 2. – P. 02024-1
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9. O. V. Sobol'. Recrystallization and formation of spheroidal gold particles in amorphous-like AlN–TiB<sub>2</sub>–TiSi<sub>2</sub> coatings after annealing and subsequent implantation / A. D. Pogrebnyak, A. A. Dem'yanenko, V. M. Beresnev, O. V. Sobol', O. M. Ivasishin, K. Oyoshi, Y. Takeda, H. Amekura, A. I. Kupchishin // Physics of the Solid State. – 2016. – Vol. 58. - Is.2. - 1453–1457
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12. Sobol O.V. Influence of pressure of working atmosphere on the formation of phase-structural state and physical and mechanical properties of vacuum-arc multilayer coatings ZrN/CrN / O.V. Sobol', A.A. Andreev, V.F. Gorban, V.A. Stolbovoy, A.A. Meylekhov, A.A. Postelnyk , A.V. Dolomanov // PAST. – 2016. – Vol. 101. – Is. 1. – P. 134–139.
13. Sobol' O.V. Influence of high-voltage constant potential bias on structure and properties of MoN/CrN multilayer composite with different layer thickness / S.S. Grankin , V.M. Beresnev, O.V. Sobol', S.V. Lytovchenko, V.A. Stolbovoy, D.A. Kolesnikov, A.A. Meylekhov, A.A. Postelnyk, I.N. Toryanik // PAST. – 2016. – Vol. 101. – Is. 1. – P. 154–159.
14. Sobol O.V. Structural engineering of the vacuum arc ZrN/CrN multilayer coatings / O.V. Sobol, A.A. Andreev, V.F. Gorban, A.A. Meylekhov, A.A. Postelnyk, V.A. Stolbovoy // Journal of Nano-and Electronic Physics. – 2016. – Vol. 8. – Is. 1. – P. 1042-1
15. Sobol O.V. Influence on mechanical characteristics of thickness of layers in MoN/CrN multilayer coatings, deposited under the influence of negative bias potential/ V.M. Beresnev, O.V. Sobol, A.V. Stolbovoy, S.V. Lytovchenko, D.A. Kolesnikov, U.S. Nyemchenko, A.A. Meylehov, A.A. Postelnyk // Journal of Nano-and Electronic Physics. – 2016. – Vol. 8. – Is. 1. – P. 1043-1
16. Sobol O.V. Study of the ion nitriding regimes on the structure and hardness of stell/ O.V. Sobol, A.A. Andreev, V.A. Stolbovoy, S.A. Knyazev, A.E. Barmin, N.A. Krivobok // Eastern-European journal of enterprise technologies. – 2016. – Vol. 2. - Is. 5(80), - 3, 63-68.
17. O. V. Sobol. Physical and mechanical properties of (Ti–Zr–Nb)N coatings fabricated by vacuum-arc deposition / V. M. Beresnev, O. V. Sobol, S. S. Grankin, U. S. Nemchenko, V. Yu. Novikov, O. V. Bondar, K. O. Belovol, O. V. Maksakova, D. K. Eskermesov // Inorganic Materials: Applied Research. – 2016. – Vol. 7, Is. 3, 388–394.
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# Proposals for joint research

We invite scientific and industrial organizations to cooperate in the field of development and introduction of new materials, coatings, the methods of quality, structure and properties assessment.

We develop and participate in educational projects, projects of establishing of joint laboratories and research centers.

We ready to take on the teaching postgraduate and graduate students from abroad.