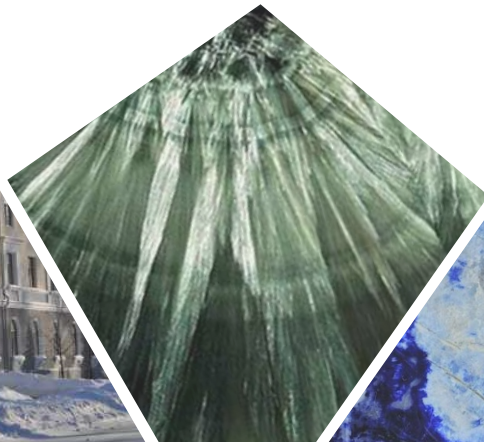




ADVANCED MAGNETIC MATERIALS WITH MULTILEVEL HIERARCHICAL STRUCTURE FOR NEW ENERGY TECHNOLOGIES, ELECTRONICS AND SPINTRONICS

The Proposal of The Scientific Project

Russian Academic
Excellence Project





SUPERVISOR OF THE PROJECT

Academician Ustinov Vladimir Vasil'yevich

“Magnetism attracts ideas and technologies: moving from base research toward high-end nanotechnologies in permanent magnets, magnetic sensors and magnetic memory”.

GOAL OF THE PROJECT

Establishment of national scientific and technological center with an international-level competency in magnetism and functional magnetic materials. The center is planned to be the basement for realization of oriented projects dedicated to advanced technologies in energy, electronics and spintronics.

OBJECTIVES OF THE PROJECT

1. Development of spintronic materials based on chiral magnetic structures

The synthesis of multilayer films with noncollinear magnetic structure; an obtaining of laterally-limited micro-objects, magnets with chiral magnetic order; the study of quantum electronic states and mechanisms of formation of spin polarized currents with a non-linear polarization; a generalization of the concept of the optical chirality for the case of chiral helimagnets; the study of magnetic and characteristics of vortex dynamics of thin films of the helimagnets CrNb_3S_6 .



Doctor of Science
A.P. Nosov



Professor
A.S. Ovchinnikov

2. Development of magnetic materials for power-conversion units which are employed at elevated temperatures and have high operating characteristics

Precipitation-hardening $\text{Sm}(\text{Co,Cu,Zr})_{7.3}$ alloys for high-temperature permanent magnets; composite heat-resistant hard magnetic materials; high-coercivity materials with low content of expensive components; hard magnetic Zr-Sm-Fe-Co-Ti system based materials with enhanced values of remanent magnetization and thermal stability; nanocrystalline and powder soft magnetic materials; materials with large magnetocaloric effect.



Academician
N.V. Mushnikov



Professor
N.V. Kudrevatykh

3. Development of film-based nanostructural magnetic materials for sensors

Materials for magnetic sensors utilizing giant and tunnel magnetoresistance effects and prototypes of the sensors; materials for thermosensitive elements based on ferrimagnetic structures; materials for magnetoimpedance sensors on flexible substrates and their prototypes; materials for elastic deformation sensors utilizing the combination of magnetosriction and magnetoresistance effects and prototypes of the sensors; composite multiferroic materials for sensors and prototypes.



Professor
V.O. Vas'kovskiy



PhD
M.A. Milyaev

4. Development of functional materials based on magnetic micro- and nanoparticles

Synthesis, attestation and investigation of magnetic gels containing micro- and nanoparticles for mechanical and biomedical applications; the study of interaction between magnetically anisotropic particles and biological objects in the presence of AC magnetic field for the purpose of methods development of oncological diseases therapy.



Professor
A.Yu. Zubarev



Doctor of Science
A.E. Ermakov

GLOBAL CHALLENGE OF THE PROJECT

Development of advanced production technologies of new functional magnetic materials with tuning multilevel hierarchical structure. Such materials having an extensive complex of physical properties provide an opportunity for breakthroughs in crucial fields of global scientific and technological progress among which there are electric power engineering, electronics including spintronics as its the latest branch and modern elements of computing systems.



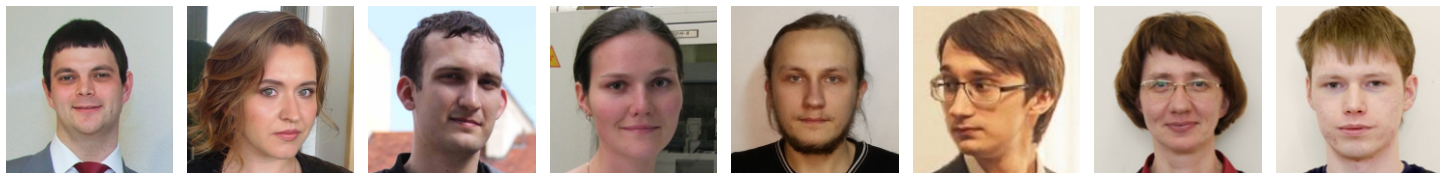
GENERAL INDUSTRIAL PARTNER

Scientific and Production Association of
automatics named after academician
N.A.Semikhatov

Ural Federal University
<http://urfu.ru>

Department of Magnetism and
Magnetic Nanomaterials UrFU
<http://km.ins.urfu.ru>

M.N. Mikheev Institute of Metal
Physics of the Ural Branch of the RAS
<http://imp.uran.ru>



THE FUTURE OF MAGNETISM IN URAL

