



# Electrical and Magnetic Properties Group

Department of Structure

Institute of Physics and Materials / Academy of Sciences of the Czech Republic

RESEARCH GROUP CONTACT >>

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## THEMATIC RESEARCH FOCUS ↘

### RESEARCH AREA

- » Material Engineering
- » Magnetic Properties
- » Physics of Metals

### EXCELLENCE

- » Mössbauer spectroscopy
- » Magnetic measurements
- » Ab-initio calculations of electronic structure of materials

### MISSION

- » To be a part of the wider top European research of nanomaterials and metal composites

## DEVELOPED TECHNOLOGIES ↘

### CONTENT OF RESEARCH

- » Theoretical studies of electronic and magnetic properties of disordered alloys, epitaxial multilayers, surfaces and interfaces as well as quantum-mechanical studies of extended defects in metallic materials
- » Experimental investigations of relations among structural and magnetic, transport and mechanical properties in metallic materials
- » Materials for hydrogen storage

### MAIN CAPABILITIES

- » Patent for textiles barcode and others, which can be modified for practical application – efficient storage of hydrogen, nanocrystalline iron and guidance systems for drugs place in the body
- » Cooperation with medium-sized companies concerned with medical equipment, treatment technology and environmental protection

### FIELDS OF RESEARCH RESULTS APPLICATION

- » Metallurgy
- » Metal Processing
- » Engineering
- » Electrical Engineering
- » Environmental Protection
- » Fuel Cells
- » Biomedicine – e.g. Magnetic Resonance

### ALUMNI PROFILE

Basic and industrial research in materials science and engineering.

## NUMBER OF RESEARCH POSITIONS ↘

### SENIOR RESEARCH STAFF

10

### JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

3



## KEY RESEARCH EQUIPMENT ↘

### LIST OF DEVICES

- » Mössbauer spectrometers (5 – 1300K)
- » VSM magnetometers (5 – 1000K)
- » Coercimeter Förster (80 – 1000K)
- » Equipment for measurements of electrical resistivity (300 – 1000K)
- » Equipment for measurements of magnetoresistance (80 – 900K, 1T)
- » Quadrupole mass spectrometer
- » Spark erosion system for material synthesis
- » Vacuum (oil free) and gas furnaces for heat treatment of materials (up to 1300K)
- » X-ray diffractometer X'PERT

## BUDGET ↘

### TOTAL (MIL. CZK/ MIL. EUR)

5 / 0.2

### PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%)

10

### PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%)

0

## MAIN PROJECTS ↘

**2011-2014:** Theory of spin-dependent transport in magnetic solids and nanostructures (project P204/11/1228 financed by the Czech Science Foundation, Investigator: doc. RNDr. Ilja Turek, DrSc.)

**2011-2014:** Effects of cores and boundaries of nanograins on the structural and physical properties of ball milled and mechanically alloyed iron-based materials (project P108/11/1350 financed by the Czech Science Foundation, Investigator: Ing. Yvonna Jirásková, PhD.)

**2005-2011:** Research center of powdered nanomaterials (project VC 1M 0512 financed by the Ministry of Education, Youth and Sports, Investigator: Ing. Oldřich Schneeweiss, DrSc.)

### ACHIEVEMENTS

- » O. Schneeweiss, R. Zbořil, N. Pizúrová, M. Mašláň, E. Petrovský, J. Tuček: Novel solid-state synthesis of  $\alpha$ -Fe and Fe<sub>3</sub>O<sub>4</sub> nanoparticles embedded in a MgO matrix. *Nanotechnology*, Vol. 17, 2006, pp. 607-616.
- » B. David, O. Schneeweiss, M. Mashlan, E. Šantavá, I. Morjan: Low-temperature magnetic properties of Fe<sub>3</sub>C/iron oxide nanocomposite. *J. Magn. Magn. Mater.* Vol. 316, 2007, pp. 422-425.
- » K. Sato, L. Bergqvist, J. Kudrnovský, P. H. Dederichs, O. Eriksson, I. Turek, B. Sanyal, G. Bouzear, H. Katayama-Yoshida, V. A. Dinh, T. Fukushima, H. Kizaki, R. Zeller: First-principles theory of dilute magnetic semiconductors, *Rev. Mod. Phys.*, Vol. 82, 2010, pp. 1633-1690.

- » Y. Jirásková, K. Zábranský, I. Turek, J. Buršík, D. Jančík: Microstructure and physical properties of mechanically alloyed Fe-Mo powder, *J. Alloys Comp.* Vol. 477, 2009: pp 55– 61.

## MAIN COLLABORATING PARTNERS ↘

### COLLABORATION WITH ACADEMIC PARTNERS

- » Faculty of Science, Masaryk University (Brno, CZ)
- » Faculty of Mechanical Engineering, Brno University of Technology (Brno, CZ)
- » Faculty of Science, Palacky University (Olomouc, CZ)
- » Textile Testing Institute (Brno, CZ)
- » Faculty of Mathematics and Physics, Charles University (Prague, CZ)
- » University of Uppsala (SE)
- » University of Belgrade (RS)
- » National Institute for Lasers, Plasma and Radiation Physics (Bucharest, RO)
- » University of Ghent (Gent, BE)

### COLLABORATION WITH COMPANIES

- » Aquatest (Liberec, CZ)
- » Nanoiron (Rajhrad, CZ)
- » Messer (DE)
- » SHM (Šumperk, CZ)
- » Honeywell (US)
- » Delong Instruments (Brno, CZ)

## EXPECTATIONS ↘

### REQUIREMENTS

Collaboration with companies - clear and exact description of the task to be solved.

### OFFERS

- » Measurements of magnetic and electrical properties of materials.
- » Structure and phase analysis using Mössbauer spectroscopy and XRD.
- » Calculation of electronic structure and related properties of selected materials

