

The Head of the Department: [Prof. Krzysztof Szwertnia, Ph.D., D.Sc.](#)

Scientific Staff

[Prof. Adam Morawiec, Ph.D., D.Sc.](#)

[Magdalena Bieda - Niemiec, Ph.D.](#)

[Anna Goral, Ph.D., D.Sc.](#)

[Anna Korniewa-Surmacz, Ph.D.](#)

[Krzysztof Kudłacz, Ph.D.](#)

Jakub Kawałko, Ph.D.

Piotr Drzymała, Ph.D.

Engineering-technical Staff

[Jan Guspiel](#) , Ph. D.

Bogusz Kania

PhD students

Research Area

· **Development of diagnosing methods for deterioration of near-the-surface layers using crystallographic texture and residual stresses-**

(
J. Bonarski, L. Tarkowski)

Modification of traditional method $\sin^2\psi$ determining the residual stresses in materials to obtain a non-destructive method evaluating a depth-profile of the stresses. The problem is especially important in materials with layered and gradient microstructure.

· **Influence of the microstructure on progress of corrosion process in ultra-fine grained Mg alloy AZ31 -** (J. Guśpiel, J. Bonarski, L. Tarkowski, K. Sztwiertnia, M. Faryna)

The investigation of intensity of corrosion process of magnesium alloy AZ31 in water solutions of NaCl versus microstructure and crystallographic texture changes due to deformation after KoBo technology and after additional tension test.

- **Analysis of crystallographic orientations of phases in multi-phase material using computer simulations -** (J. Jura, A. Góral, M. Kowalski)

Modeling processes of forming the cold-rolling texture in ferritic-austenitic steel by means of the Finite Elements Method. Analysis of microtexture changes in eutectic Cu-CuAl₂ alloy after directional solidification.

- **Characterization of quantitative changes of texture in plastic deformation and thermal treatment processes of single- and multiphase materials with cubic lattice -** (J. Jura)

Application of the back-scattering electron diffraction technique for characterization of microstructure of polycrystalline materials (single-phase silicon steel and multiphase duplex steel).

- **Analysis of crystallographic textures and the related problems -** (A. Morawiec, K. Kudłacz)

Numerical and formal aspects in description of texture, microstructures and properties of polycrystalline materials.

- **Development of measurement technique of grain boundary topography and method its characterization based on the maps of crystallographic orientations registered by means of SEM and TEM -** (K. Sztwiertnia, M. Faryna, A. Morawiec, M. Bieda, A. Korneva)

Characterization of orientation of the multi-phase areas with ultra-fine grains obtained under the complex deformation state of the hard-magnetic materials.

- **Mechanisms of grain refinement during continuous recrystallization process in aluminum alloys with bi-modal distribution of the precipitates -** (K. Sztwiertnia, M.

Faryna,
. Bieda, A. Korneva
)

M

New methods obtaining materials with ultra-fine grained structure.

Research Projects from Ministry of Science and Higher Education

Individual projects

- J. Pospiech – Modifications of microstructure and texture structural Mg-alloys for improvement technology of forming, Project No. N507 110 32/3305, IMMS PAS, supervisor, 2007-2009.
- K. Sztwiertnia – Adaptation a system of automatic TEM-measurement of orientation maps to microstructure analysis in severely deformed metals, Project No. N507 159 31/1148, IMMS PAS, supervisor, 2006-2008.
- K. Sztwiertnia – Mechanisms of grain refinement during continuous recrystallization process in aluminum alloys with bi-modal distribution of the precipitates. New method obtaining materials with ultra-fine grained structure, Project No. N507 047 31/1152, IMMS PAS, supervisor, 2008-2010.

Development projects

- J. Bonarski – Prototype of a mobile device for monitoring process of deterioration of wheel in railway vehicles, Project No. N R15 0448 04/2008, IMMS PAS, supervisor, 2008-2010.

Solicited national projects

- J. Jura – Improvement of competition and innovation of national non-ferrous metal processing industry by study of advanced metallic materials and technology of its fabrication. Project No. PBZ-MNiSW-3/3/2006, IMMS PAS, Leader of task 1.5:
Multi-scale, quantitative characteristics of microstructure of the advanced metallic materials, 2007-2009.

European Union Projects

- Maria Curie Actions – *Advancing orientation and strain determination with high spatial resolution* –
Universite de Metz, IMMS PAS, A. Morawiec, 2005-2008.

International cooperation

- J. Bonarski – Texture and microstructure investigations, and computer simulations of the related material processes of severe plastic deformation, Institute of Physics of Advanced Materials, Department of Nanotechnology and Department of Physics of Ufa State Aviation Technical University, Russia, since 2004.
- J. Bonarski, L. Tarkowski – Analysis of structure gradients in SPD nano-magnesium & -alloys, Materials Physics Institute of University of Vienna, 2006-2007.
- J. Bonarski, L. Tarkowski – Accounting for secondary extinction in texture analysis of polycrystalline materials, Institute of Physical Chemistry, Bulgarian Academy of Sciences, 2007-2008.

PhD dissertation

- 2007 – Leszek Tarkowski, Application of crystalline texture topography method in investigation of surfach structure (Supervisor: J. Bonarski).
- 2007 – Anna Góral, Dependence of microstructure on rate of oriented crystallization of plate-structure eutectic in Al-CuAl alloy (Supervisor: J. Jura).
- 2007 – Marcin Kowalski, Modeling processes of forming the cold-rolling texture in ferritic-austenitic steel by means of the FEM (Supervisor: J. Jura).
- 2008 – Magdalena Bieda-Niemiec, Elaboration of a system of automatic TEM-measurement of orientation maps to microstructure analysis in ultra-fine grained metallic materials (Supervisor: K. Sztwiertnia).
- 2008 – Anna Korneva, The influence of complex deformation state on microstructure and properties of the hard-magnetic Fe-Cr-Co materials (Supervisor: K. Sztwiertnia).
- 2009 – Grzegorz Sawina, Computer simulation of recrystallization and grain growing processes in metals with hexagonal lattice using the cellular automate (Supervisor: K. Sztwiertnia).

PhD in progress

- Sylwia Pawlak – Detection of areas of potential material deterioration based on parameters of its microstructure (Supervisor: J. Bonarski).

Other activities and scientific achievements

- J. Jura – Workshop MMM Macro-, mezo-, micro-scale characterization of microstructure (2009), Kraków, chairman.
- J. Bonarski – Symposium on texture and microstructure analysis – SOTAMA (2004, 2007), Kraków, chairman.
- J. Bonarski – International Texture Workshops Measurement & Interpretation (2004, 2007), Kraków, chairman.
- K. Sztwiertnia – Management Committee of COST 525 action: Advanced electroceramics: grain boundary engineering (2004-2006) Member of the Committee (level of national representative).
- K. Sztwiertnia – International Workshop Progress in microstructure characterization by electron microscopy – MicroCEM (2005), Kraków, chairman.
- J. Bonarski – MILAB competition of the Foundation for Polish Science (2005), laureate.
- K. Sztwiertnia – XI Conference on electron microscopy of solids (2002), Member of Organizing Committee.
- J. Bonarski – Golden Cross of Merit for the scientific achievements

