

DEPARTMENT FOR NANOSTRUCTURED MATERIALS K-7

The basic and applied research in the Department for Nanostructured Materials includes ceramic materials, intermetallic alloys and minerals. Our research encompasses conventional processing as well as the development of new technologies and methods for preparing new materials with novel properties. It includes experimental and theoretical investigations of structures, analyses of chemical compositions at the atomic level, and measurements and calculations of physical properties, all of which help us to improve the properties of micro- and nanostructured materials.

In the frame of a European Network of Excellence we continued our research on **quasicrystals** as promising **materials for hydrogen storage**. We focused on two compositions: $Ti_{40}Zr_{40}Ni_{20}$ and $Ti_{45}Zr_{35}Ni_{17}Cu_3$. With a systematic experimental approach we established the optimal conditions for the processing of ribbons by melt-spinning and the methods for their characterizations. In accordance with the literature data we showed that copper accelerates quasicrystalline i-phase formation, but it inhibits hydrogen uptake. Ribbons were crushed in a protective argon atmosphere in order to increase the amount of clean surface for hydrogen-molecule dissociation, and we hydrided the samples under a hydrogen pressure of 40 bar and temperatures between 200 and 300°C. From the XRD peak shift after absorption we were able to calculate the expansion of the quasilattice and the content of hydrogen using literature data. We also observed a drop of magnetization with hydrogen content, which was measured by means of mass spectrometry of the desorbing hydrogen. The obtained powders were examined by HRTEM and the i-phase was observed and determined. The results were included in a publication that was accepted by the Journal of Alloys and Compounds; they were also presented to the international and domestic scientific communities.

We continued with our research on **magnetocaloric materials**, which are important for **magnetic refrigeration**, an ecological technology. Research focussed on the $Gd_5Si_2Ge_2$ and $Gd_5Ge_2(Fe_xSi_{1-x})_2$ systems. The $Gd_5Si_2Ge_2$ samples were prepared by two methods: with an arc-melter and a melt-spinner. With the arc-melter we observed how the cooling rate affects the macro- and microstructure of the samples. These materials show complex surface macrostructure features, which vary from a sinew-like structure at very fast cooling rates through to an almost Fullerene-like structure at slower cooling rates. Transmission electron microscopy (TEM) showed numerous twins in the sample. With a melt spinner we produced ribbons of different shapes, depending on the wheel speed the structure changed from amorphous to crystalline. With TEM we observed a larger number of twins than in the samples made with arc melting. The results were presented at the 2nd International Conference of the IIR on Magnetic Refrigeration at Room Temperature, THERMAG 2007. Samples from the $Gd_5Ge_2(Fe_xSi_{1-x})_2$ system were only arc melted. With the addition of Fe the Fullerene-like macrostructure slowly disappeared and conventional ingots with smooth surfaces resulted. Iron also reduced the Curie temperature and encouraged the formation of the $Gd_5(SiGe)_3$ phase at the expense of the magnetocaloric $Gd_5(SiGe)_4$ phase. We observed a reduction of the hysteresis losses, which was the purpose of the Fe addition, because high hysteresis losses have a negative effect on the cooling capacity during magnetic refrigeration. We also investigated technologically interesting materials by means of calculations within the framework of the density-functional theory. These studies were focussed on magnetocaloric materials and on the properties of complex metallic alloys.

In the field of **magnetic thin films** we continued with our research on Sm-Fe-Ta films processed by pulsed-laser deposition and on films based on CoPt produced by a chemical method. Both materials have the potential for MEMS applications. CoPt has a very strong perpendicular magnetocrystalline anisotropy and excellent resistance to oxidation and corrosion. The $Co_{0.5}Pt_{0.5}$ is related to the presence of the ordered L10 phase. This is a natural multilayer, which consists of alternating pure Co and pure Pt (001) planes. The strong crystallographic anisotropy is associated with a strong magnetic anisotropy due to the strong magnetic spin-tir coupling on the Pt and the strong



Head:

Prof. Spomenka Kobe

A test series of ceramic ball-heads for hip-joints with a gradient composition, produced in the frame of the European project "Biograd", were tested. The results confirmed that the new grade of functionally graded ceramic hip-joints allows a higher load than the commercially available alumina. Cordis published an offer for the new industrial technology on the web.

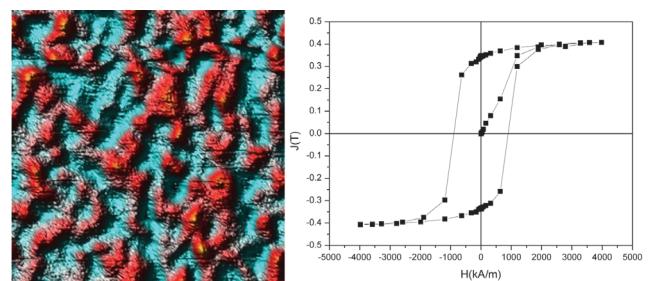


Figure 1: MFM image and hysteresis loop of a thermally treated thin layer of CoPt-700°C/1h/Ar+H2 for MEMS application.

hybridization between the Pt 5d and the Co 3d states. The CoPt thin films (20-600 nm) were synthesized using the electrodeposition method and characterized with a SQUID magnetometer and with AFM/MFM. The as-deposited films are cubic and nanocrystalline with grain sizes between 10 and 80 nm. The magnetization lies in the plane, and therefore the coercivity is low. An MFM image shows that interaction domains are present in the material. On the other hand, the annealed film which contains the L10 phase has a coercivity of $\mu_0 H_c = 1.2 \text{ T}$ and displays interconnected stripe domains corresponding to the up and down orientations of the magnetization.

In ZnO ceramics doped with very small amounts of Sb_2O_3 (< 0.017 mol.%) the kinetics of the grain growth under the influence of inversion boundaries (IBs) was explained. An equilibrium layer, with about the same amount of Sb as that at the IB, is formed at the grain boundaries of Sb-doped ZnO. The concentration of the Sb at the grain boundaries can be expressed with the equation: $C_m(\text{Sb}) = 3C_{IB}(\text{Sb}) = 0.300/\text{G}$. At additions of Sb below the amount required for the formation of an equilibrium layer, Sb triggers the formation of IBs in a reduced number of ZnO grains, depending on the amount - a lower number for smaller, and a higher number for larger additions of Sb. Under such conditions either coarse- or fine-grained ZnO ceramics can be developed. As long as grains with IBs can grow at the expense of normal grains the kinetic grain-growth exponent n is 2, which indicates that grain growth is indeed dictated by the growth of a thermodynamically stable two-dimensional structure of IBs. The longer is the period of grain growth, the larger the ZnO grains can grow. Once the ZnO grains with IBs prevail in the

microstructure, the grain growth is slowed and the grain-growth exponent n increases to 4. For additions of Sb above the amount required for the formation of an equilibrium layer, Sb triggers the formation of IBs in most of the ZnO grains, which results in fine-grained ZnO ceramics. The strong inhibition of the grain growth in this case is also indicated by the grain-growth exponent n being above 10. Based on the investigations of ZnO ceramics doped with very small amounts of Bi_2O_3 and Sb_2O_3 , the main parameters that influence grain growth and microstructure development in the basic system of varistor ceramics under the influence of inversion boundaries (IBs) were recognised. The obtained fundamental knowledge enabled us to be the first to succeed in the preparation of Bi_2O_3 - and Sb_2O_3 -doped ZnO ceramics with an average grain size several times larger than in pure ZnO under the same sintering conditions, which was, in general, considered to be impossible. Guided by a fundamental knowledge of the microstructure development under the influence of inversion boundaries (IBs) we continued with research activities on low-doped varistor ceramics. Based on a systematic analysis of the influence of very small amounts of Al_2O_3 (< 0.12 mol.%) on the microstructural and electrical characteristics we proposed a mechanism which, in such a complex system of varistor



Figure 2: Test series of ceramic ball-heads for hip joints with a gradient composition were produced in the frame of the European project "Biograd". (http://cordis.europa.eu/fetch?CALLER=OFFR_TM_EN&ACTION=D&DOC=2&CAT=OFFRE&QUERY=1197645527573&RCN=3420)

ceramics, explained the inhibition of the grain growth by the small amounts of Al_2O_3 in the Bi_2O_3 -rich liquid phase and the influence of Al_2O_3 on the nature of the grain boundaries. Also, alternative approaches to the preparation of varistor ceramics via the direct mixing of pre-reacted varistor phases and by mechano-chemical activation of the starting powder with intensive milling was studied. Several formulations with 2 to 3 times smaller amounts of dopants added to the ZnO in comparison to the standard compositions were developed. They enabled the preparation of varistor ceramics with characteristic breakdown voltages in the range 80–240V/mm. Some of these compositions are already being tested at our industrial partner for **industrial processing and applications in various types of varistors**.

Grain-growth studies of zinc oxide ceramics have indicated that inversion boundaries (IBs) are the growth faults that control the growth of the ZnO grains. To substantiate this observation we designed experiments to study the nucleation of IBs. Low-temperature experiments showed that in the ZnO-SnO₂ system IBs form before the Zn₂SnO₄ spinel phase and grains with IBs grow exaggeratedly at the expense of the normal ZnO grains until they completely dominate the microstructure. Experiments using ZnO single crystals embedded into ZnO powder with the addition of SnO₂, Sb_2O_3 and In₂O₃ showed that, depending on the oxidation state of the IB-forming dopant ions, there are two competing mechanisms of IB nucleation: (i) internal diffusion, and (ii) surface nucleation and growth. The first mechanism is typical for III⁺ dopants and is controlled by Zn-vacancy diffusion, whereas the second mechanism holds for all IB-forming dopants and is controlled by the chemisorption of the dopants on Zn-deficient (0001) surfaces. In both cases the driving force for the inversion is the preservation of the local charge balance. We also started with the research activities on the synthesis of **ZnO nanostructures** using the solid-vapour phase thermal sublimation method. ZnO-based nanostructures could find applications in optoelectronics, sensors, transducers and biochemical science because ZnO is bio-safe. Preliminary studies were focused on the influence of processing on the morphology of ZnO nanostructures obtained on various substrates with the aim to define the

conditions for the reproducible preparation of the desired ZnO nanostructure. The formation and the structure of nanosized ZnO particles were studied using electron microscopy techniques. Nucleation, self-assembly and the morphology of very interesting features, like tetrapods, wires, needles, twinned crystals, were examined.

In the frame of European project "Meddelcoat" we are involved in **an improvement to the ingrowths of the metal part of the prosthesis into bone**. In order to protect the metallic stem from corrosion, to prevent the leaching and diffusion of metal ions into the body and to improve the adhesion of the bioactive coatings, we investigated the in-situ hydrothermal synthesis of a thin layer of TiO_2 at the surface of the alloy. We successfully synthesized a 100-nm-thick anatase layer. Anatase is the most bioactive form among the different allotropic modifications of TiO_2 . The idea of the project is to coat the metal stem with a thin layer of bioglass, which is said to accelerate the integration of the implant with the surrounding tissue. Since it was not possible to obtain bioglass of high purity with small enough particles we introduced a sol-gel synthesis. In contrast to the conventional procedure involving milling we obtained powder with sub-micrometer sized particles. The bioglass coating on the surface of the alloy was made by means of **electrophoretic deposition** from the suspension of the powder or electrodeposition in the sol. The second part of the research in the frame of the Meddelcoat project is focused on the **production of porous scaffolds** with an improved capability for bone ingrowth. Firstly, we have looked to learn from Nature and would like to mimic it in the future. As an example of a natural hard tissue with superior mechanical properties we have investigated a tooth composition and structure on the micro and nano levels. It is known that tooth is composed of elongated and oriented crystals of calcium phosphates (among which is hydroxyapatite) and that this specially organized structure is the basis for its extraordinary mechanical strength and resistance to cracks. In the future we will concentrate on the synthesis of anisotropic hydroxyapatite crystals and the preparation of porous scaffolds with better properties than those that are commercially available.

A lot of attention was paid to research on electrophoretic deposition, which was used for the preparation of thin and thick deposits on various metal substrates. We used aqueous and non-aqueous suspensions of oxide and non-oxide particles of nanometre size. We have ascertained that the method enables the preparation of green deposits with great homogeneity, but for the preparation of dense deposits with low shrinkage during sintering, besides de-agglomeration, the suitable addition of a surface-active agent plays a key role. Special attention was focussed on the properties of SiC powder and on the applicability of electrophoretic deposition for the infiltration of the fabric made from SiC fibres. We have investigated the **electrokinetic properties** of the powder in water-based suspensions across the whole pH range and hence enabled tailoring of the suspension's properties to the properties of the fibre fabric. The results of the infiltration of the SiC powder are used in the development of a **SiC/SiC composite for use in a future fusion reactor**. These studies have been going on for four years within the framework of the European fusion program. Besides the development of a suitable technique for the preparation of a continuous-fibre reinforced ceramic composite and the deposition of suitable coating onto fibres, a lot of effort was made to densify the ceramic matrix below a temperature of 1500°C. In cooperation with the F8 department we have verified the suitability of some potential sintering additives (regarding the expected activation after irradiation), and at the end of the year the selected sintered samples were irradiated. The results are promising; the activation of the sintered samples is considerably lower than the activation of Eurofer steel, which will be used in the experimental ITER reactor. In the field of fusion-related materials we continued to study the interfaces between the SiC fibres and the SiC-based matrix material. This interface enhances the mechanical properties of the composite material. Using physical vapour deposition various materials were used as the interface (WC, CrC, DLC, etc.), and the adhesion and microstructure were studied.

In cooperation with other groups from Slovenia and other countries in Europe we studied the microstructure, nucleation and crystallisation of different materials as a function of preparation conditions. We continued with our research on **germanium quantum-dots** embedded in an amorphous SiO_2 matrix. Ge was prepared using the ion-implantation technique and heat treated at different temperatures. In certain conditions the self-assembly of the particles took place. Using high-resolution electron microscopy and Z-contrast microscopy we studied the formation of the self-assembled systems.

A member of the department, Katja Rade, was presented with the Prešeren award for her diploma work, which was performed at the Faculty of Chemistry and Chemical Engineering.

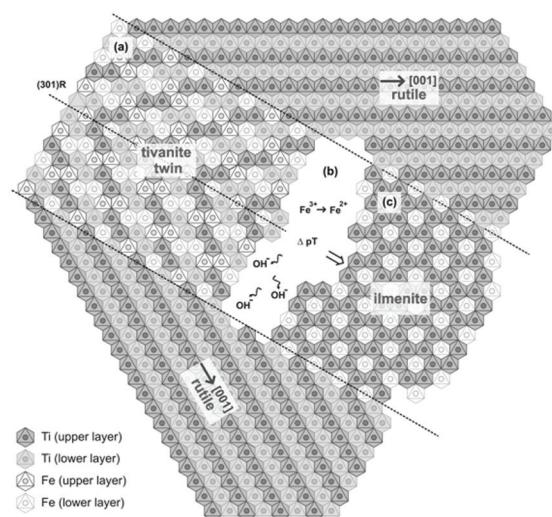


Figure 3: Schematic representation of an intrinsically twinned tivanite platelet and epitaxial nucleation of rutile crystals in the (301) twinned orientation. Dehydration of the tivanite platelet, resulting in the nucleation of ilmenite lamella with the corundum structure.

We started with the investigations of **nanosized particles used for catalytic applications**. Materials such as TiO_2 , CeO_2 , and Ce-Cu-O were prepared by "wet" routes and were studied by analytical electron microscopy. The influence of preparation conditions on morphology, size, crystallinity and crystal defects was examined. Preliminary results were presented at an international conference and will be published.

In the area of the development and implementation of atomically resolved **HAADF-STEM microscopy** we showed, using the model materials $CaTiO_3$, $SrO-SrTiO_3$ and $Na_2NaNb_5O_{10}$, that the local lattice distortions significantly influence the experimentally determined intensities of single-atom columns. Furthermore, we showed that realistic values of the Debye-Waller factor for atoms comprising the investigated structure (interface, planar fault, etc.) are needed for an exact quantitative interpretation of the experimental HAADF-STEM intensities. Only then can the intensities of the atom columns in the simulated images correspond to the true values and can they be successfully compared with the intensities in simulated images. For the $Pb(Mg,Nb)O_3-PbTiO_3$ (PMN-PT) material we implemented a mechanical polishing technique for the preparation of thin foil specimens for TEM observations (the tripod method). A comparison of the results on the chemical composition of thin foils prepared by ion-milling and mechanical polishing (tripod) showed that only the specimens prepared by the tripod method are suitable for a chemical analysis using EDXS. This is because ion-milling causes extensive damage to the thin foil and changes the chemical composition in the damaged region due to Pb evaporation. It was concluded that any analytical results performed using EDXS on materials containing Pb may be questionable if ion-milling is used for the sample preparation.

We continued with the synthesis and characterization of **nanorods with the perovskite structure** $ATiO_3$ ($A= Ba, Sr, Ca$) with the electrophoresis (electrodeposition) of sols into ordered arrays of nano-sized channels of anodic alumina and into pores in polycarbonate membranes. By using TEM and electron diffraction analysis we found that these nanorods are dense and polycrystalline, with the grain size ranging between 25 and 50 nm. The length of the nanorods is approximately 10 μm , with the diameter of an individual nanorod being in the range 100–180 nm.

One of the important accomplishments in the past year was the **publication of a scientific monograph** entitled "Mineral localities of Slovenia". On the 384 pages all the major Slovenian mineral localities are described: the book starts with a historical background, before providing a geographical description, and a description of the geology and information about the formation of the minerals. In addition to mineral paragenesis the descriptions include a complete geological background necessary to understand the individual mineral occurrences. The special value of this approach is that each of the described localities is placed into a specific tectonic setting related to individual orogen phases on the territory of Slovenia. The monograph will be of a great educational value as supplementary material for university studies, while the synthesis of the knowledge from various scientific disciplines in this book will be valuable to a wide professional community from the fields of geology, ore exploration,

mineralogy, solid-state chemistry and Nature preservation.

The structure and chemistry of (111) **twins in $MgAl_2O_4$ spinel crystals** from Pinpyit near Mogok (Myanmar, formerly Burma) were studied using methods of transmission electron microscopy (TEM). Crystallographically, (111) twins of spinel can be described by a 180° rotation of the oxygen sublattice normal to the twin composition plane. This operation generates a local *hcp* stacking in an otherwise *ccp* lattice and maintains a regular sequence of kagome and mixed layers. In addition to rotation, no other translations are present in the (111) twins in these spinel crystals. Quantitative analyses of the HRTEM (phase contrast) and the HAADF-STEM (Z-contrast) images of the (111) twin boundary have confirmed that Mg^{2+} ions are replaced with Be^{2+} ions in the boundary tetrahedral sites. The Be-rich twin-boundary structure is closely related to the $BeAl_2O_4$ (chrysoberyl) and $BeMg_3Al_8O_{16}$ (taaffeite) groups of intermediate polysomatic minerals. The formation of (111) twins is a preparatory stage of polytype/polysome (taaffeite) formation and is a result of the thermodynamically favourable formation of *hcp* stacking due to Be incorporation on the {111} planes of the spinel structure in the nucleation stage of crystal growth. Twinned crystals of rutile (TiO_2) from Diamantina in Brazil were investigated using analytical transmission electron microscopy methods. A high-resolution transmission electron microscopy (HRTEM) imaging of the (301) twinned rutile revealed the existence of a coherent interlayer at the twin boundary. The interphase lamella with a lateral width of a few nanometres consists of ilmenite ($FeTiO_3$) containing some Al. The orientation relationship between the ilmenite lamella and the epitaxial rutile crystals is $(011\bar{0})[0001]_I \parallel (301)[010]_R$. The lattice mismatch between

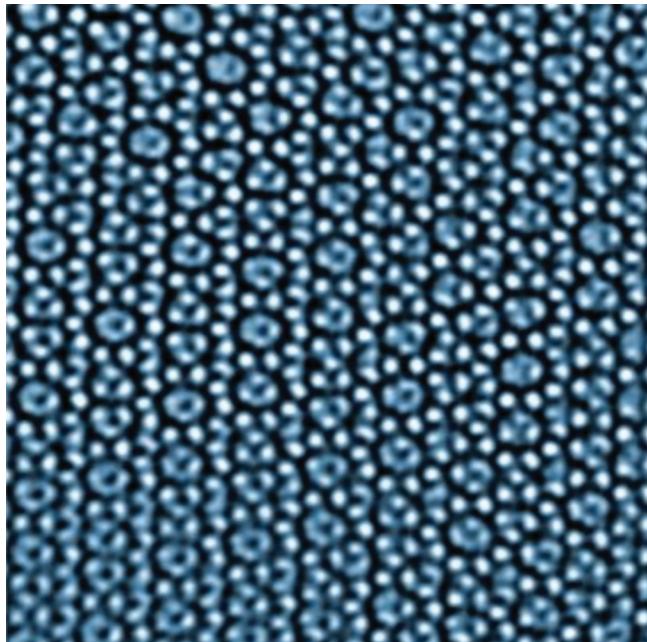


Figure 4: Icosahedral phase of a quasicrystal of $Ti_{40}Zr_{40}Ni_{20}$, observed by HRTEM (Fourier filtering of the HRTEM image using Digital Micrograph software)

the ilmenite and the rutile appears to be compensated by the incorporation of Al into the ilmenite. The presence of goethite-related reflections and the existence of nanotwins in the ilmenite lamella imply that it formed via a thermally induced dehydration process from an oxyhydroxide precursor mineral with a tivanite-type structure. This lamella subsequently served as a nucleation site for the epitaxial growth of rutile domains in a (301) twin configuration.

For industry we studied the structure and chemical composition of nanometre-sized layers based on Al_2O_3 - SiO_2 and TiO_2 pigments. The results of the work over the past few years were collected in the final report of the Centre of Excellence: Nanosciences and Nanomaterials. For various customers a determination of the asbestos fibres in air, water and soils was performed using analytical electron microscopy.

We also carried out analyses in the field of electron-probe microanalysis (SEM, EDXS, WDXS) for several industrial partners: DONIT-TESNIT, Medvode; COMET, Zrečje; LEK, Ljubljana; TE-TOL, Ljubljana; EMO-FRITE, Celje; LE-TEHNIKA, Kranj; and ISKRAEMECO, Kranj.

Members of the department are heavily involved in managing the **Center for Electron Microscopy** within the frame of the national infrastructure Center for Microstructural and Surface Analysis. The implementation of various electron microscopy analytical techniques and the possibility for researchers to access a research infrastructure for electron microscopy is of utmost importance for numerous research institutions, industrial partners as well as for graduate and post-graduate education.

Some outstanding publications in 2007

1. Aleksander Rečnik, Nina Daneu, Slavko Bernik. Nucleation and growth of basal-plane inversion boundaries in ZnO . *J. Eur. Ceram. Soc.*, 2007, vol. 27, no. 4, pp. 1999–2008.
2. Slavko Bernik, Nina Daneu. Characteristics of ZnO -based varistor ceramics doped with Al_2O_3 . *J. Eur. Ceram. Soc.*, 2007, vol. 27, str. 3161–3170.
3. Spomenka Kobe, Evangelia Sarantopoulou, Goran Dražić, Janez Kovač, Mersida Janeva, Zoe Kollia, Alciviadis-Constantinos Cefalas. Growth of crystalline/amorphous biphasic Sm-Fe-Ta-N magnetic nanodroplets. *Appl. surf. sci.*, 2007, vol. 254, no. 4, pp. 1027–1031.
4. Saša Novak, Mitjan Kalin, Anne P. Lukas, Jozef G. Vleugels, Omer Van Der Biest. The effect of residual stresses in functionally graded alumina-ZTA composites on their wear and friction behaviour. *J. Eur. Ceram. Soc.*, 2007, vol. 27, pp. 151–156.
5. C. Kostoglou, Matej Komelj, Manfred Fähnle. Theory of x-ray absorption spectroscopy in solids : mixing of the core states by the aspherical effective potential. *Phys. rev., B, Condens. matter mater. phys.*, 2007, vol. 75, no. 21, pp. 214426-1–214426-5.

Patent granted

1. Saša Novak, Katja König, Stojana Vesović-Bukudur, A method for hydrophobisation of a ceramic powder by applying an organic coating in an aqueous suspension: Patent No. 22211, Ljubljana, Slovenian Intellectual Property Office, Ljubljana, Slovenia, 2007.

Awards and appointments

1. Nataša Drnovšek: "A double-layer coating on a $\text{Ti}_6\text{Al}_4\text{V}$ alloy for biomedical applications". Winning contribution of young scientists at the 15th Conference on Materials and Technologies in the field "Anorganic Materials", Portorož, October 8–10, 2007.
2. Katarina Rade: "Study of polymethacrylic acid in presence of various cations in aqueous media". Winning contribution of young scientists at the 15th Conference on Materials and Technologies in the field "Nanomaterials and Nanotechnologies", Portorož, October 8–10, 2007.
3. Kristina Žagar: "Synthesis and characterization of perovskite nanorods". Winning contribution of young scientists at the 15th Conference on Materials and Technologies in the field "Nanomaterials and Nanotechnologies", Portorož, October 8–10, 2007.
4. Katarina Rade: "Effect of valency of counterion on behaviour of two stereoisomers of polymethacrylic acid in aqueous solutions". Prešeren Prize of the Faculty of Chemistry and Chemical Technology, University of Ljubljana for the best B.Sc. thesis in 2007 (mentor: Prof. Ksenija Kogej); 7 December 2007

One of the most important accomplishments in the past year was the publication of a scientific monograph entitled "Mineral localities of Slovenia". On the 384 pages all the major Slovenian mineral localities are described: starting with a historical background, the book provides a geographical description, presents the geology and describes the formation of the minerals.

Organization of conferences, congresses and meetings

1. SLONANO2007, Ljubljana, 10–12 October 2007
2. 15th Conference on Materials and Technology, Portorož, 8–10 October 2007 (co-organisation)
3. European School in Materials Science: Properties and Application of Complex Metallic Alloys, Ljubljana, 21–26 May 2007 (co-organisation)
4. 8 Multinational Congress on Microscopy (8MCM), Prague, Czech Republic, June 17–21 (members of International Advisory Board)

BIBLIOGRAPHY

ORIGINAL ARTICLES

1. Andreja Benčan, Barbara Malič, Goran Dražić, Mišo Vukadinović, Marija Kosec
Characterization of lead zirconate titanate - lanthanum ruthenate thin film structures prepared by chemical solution deposition
In: Scanning, Vol. 29, no. 6, pp. 287–293, 2007.
2. Slavko Bernik, Janez Bernard, Nina Daneu, Aleksander Rečnik
Microstructure development in low-antimony oxide-doped zinc oxide ceramics
In: J. Am. Ceram. Soc., Vol. 90, no. 10, pp. 3239–3247, 2007.
3. Slavko Bernik, Goran Branković, Saša Rustič, Milan Žunić, Matejka Podlogar, Zorica Branković
Microstructural and compositional aspects of ZnO-doped varistor ceramics prepared by direct mixing of the constituent phases and high-energy milling
In: Ceram. int., 8 p., [in press] 2007.
4. Slavko Bernik, Nina Daneu
Characteristics of ZnO-based varistor ceramics doped with Al₂O₃
In: J. Eur. Ceram. Soc., Vol. 27, pp. 3161–3170, 2007.
5. Slavko Bernik, Matejka Podlogar, Nina Daneu, Aleksander Rečnik
Grain-growth phenomena in ZnO-based ceramics: [presented at Third International Conference on Recrystallization and Grain Growth, 10–15 June 2007, Jeju Island, Korea]
In: Mater. sci. forum, Vol. 558–559, pp. 857–862, 2007.
6. Ante Bilušić, Ana Smontara, Janez Dolinšek, Paul J. McGuiness, H. R. Ott
Phonon scattering in quasicrystalline i-Al₇₂Pd_{19.5}Mn_{8.5}: a study of the low-temperature thermal conductivity
In: J. alloys compd., Vol. 432, pp. 1–6, 2007.
7. Aldo R. Boccaccini, Florentina Chicatun, Johann Cho, Oana Bretcanu, Judith A. Roether, Saša Novak, Qizhi Chen
Carbon nanotube coatings on bioglass-based tissue engineering scaffolds
In: Adv. funct. mater. (Print), 9 p., [in press] 2007.
8. Zorica Branković, Goran Branković, Slavko Bernik, Milan Žunić
ZnO varistors with reduced amount of additives prepared by direct mixing of constituent phases
In: Refereed reports of IX Conference & Exhibition of the European Ceramic Society: 19–23 June 2005, Portorož, Slovenia, Journal of the European ceramic society, vol. 27, no. 2–3, 2007, Marjeta Maček, ed., Danilo Suvorov, ed., Amsterdam, Elsevier, 2007, pp. 1101–1104.
9. L. M. Cha, Christina Scheu, Gunther Richter, T. Wagner, Sašo Šturm, Manfred Rühle
First observation of a hexagonal close packed metastable intermetallic phase between Cu and Al bilayer films
In: Int. j. mater. res., Vol. 98, no. 8, pp. 692–699, 2007.
10. Zorica Crnjak Orel, Alojz Anžlovar, Goran Dražić, Majda Žigon
Cuprous oxide nanowires prepared by an additive-free polyol process
In: Cryst. growth des., Vol. 7, no. 2, pp. 453–458, 2007.
11. Nina Daneu, Aleksander Rečnik, Takashi Yamazaki, Tadej Dolenc
Structure and chemistry of (111) twin boundaries in MgAl₂O₄ spinel crystals from Mogok
In: Phys. chem. miner., Vol. 34, pp. 233–247, 2007.
12. Nina Daneu, Herbert Schmid, Aleksander Rečnik, Werner Mader
Atomic structure and formation mechanism of (301) rutile twins from Diamantina (Brazil)
In: Am. mineral., Vol. 92, 11 p., [in press] 2007.
13. Katarina Djuriš, Goran Branković, Zorica Branković, Slavko Bernik, Milica Počuća, Dejan Poleti, Bratislav Antić
Synthesis of pure and doped LaMnO₃ powders from citrate precursors: [presented at Fundamentals of Deformation and Annealing, International Symposium held to coincide with the retirement of Professor John Humphreys in Manchester, UK, 5–7 September 2006]
In: Mater. sci. forum, Vol. 555, pp. 237–242, 2007.
14. Janez Dolinšek, Peter Jeglič, Matej Komelj, Stanislav Vrtnik, Ana Smontara, I. Smiljanić, Ante Bilušić, J. Ivković, D. Stanić, E. S. Zijlstra, Birgitta Bauer, P. Gille
Origin of anisotropic nonmetallic transport in the Al₈₀Cr(15)Fe₅ decagonal approximant
In: Phys. rev. B, Condens. matter mater. phys., Vol. 76, no. 17, pp. 174207–1–174207–13, 2007.
15. Janez Dolinšek, Paul J. McGuiness, Martin Klanjšek, Igor Smiljanić, Ana Smontara, E. S. Zijlstra, S. K. Bose, I. R. Fisher, M. J. Kramer, P. C. Canfield
Reply to “Comment on ‘Extrinsic origin of the insulating behavior of polygrain icosahedral Al-Pd-Re quasicrystals’”
In: Phys. rev. B, Condens. matter mater. phys., Vol. 76, no. 21, pp. 216202–1–216202–3, 2007.
16. Claude Ederer, Matej Komelj
Magnetic coupling in CoCr₂O₄ and MnCr₂O₄: an LSDA + U study
In: Phys. rev. B, Condens. matter mater. phys., Vol. 76, no. 6, pp. 064409–1–064409–9, 2007.
17. Gert Gassner, Jörg Patscheider, Paul H. Mayrhofer, Sašo Šturm, Christina Scheu, Christian Mitterer
Tribological properties of nanocomposite CrC_x/a-C:H thin films
In: Tribol. lett., Vol. 27, pp. 97–104, 2007.
18. Peter Jeglič, Matej Komelj, Martin Klanjšek, Uroš Tkalec, Stanislav Vrtnik, M. Feuerbacher, Janez Dolinšek
Orientation-dependent NMR study of the giant-unit-cell intermetallics β-Al₃Mg₂, Bergman-phase Mg₃₂(Al, Zn)₄₉ and ξ-Al₇Pd₂₃Mn₄
In: Phys. rev. B, Condens. matter mater. phys., Vol. 75, no. 1, pp. 014202–1–014202–15, 2007.
19. Spomenka Kobe, Evangelia Sarantopoulou, Goran Dražić, Janez Kovač, M. Janeva, Zoe Kollia, Alciviadis-Constantinos Cefalas
Growth of crystalline/amorphous biphasic Sm-Fe-Ta-N magnetic nanodroplets
In: Appl. surf. sci., 18 p., [in press] 2007.
20. Andraž Kocjan, Paul J. McGuiness, Maša Rajić Linarić, Spomenka Kobe
Amorphous-to-quasicrystalline transformations in the Ti-Zr-Ni and Ti-Hf-Ni systems
In: J. alloys compd., 6 p., [in press] 2007.
21. C. Kostoglou, Matej Komelj, Manfred Fähnle
Theory of x-ray absorption spectroscopy in solids: mixing of the core states by the aspherical effective potential
In: Phys. rev. B, Condens. matter mater. phys., Vol. 75, no. 21, pp. 214426–1–214426–5, 2007.
22. Marjan Marinšek, Jana Padežnik Gomilšek, Iztok Arčon, Miran Čeh, Alojz Kodre, Marijan Maček
Structure development of NiO-YSZ oxide mixtures in simulated citrate-nitrate combustion synthesis
In: J. Am. Ceram. Soc., 8 p., [in press] 2007.
23. Matjaž Mazaj, Nataša Zubukovec Logar, Gregor Mali, Nataša Novak Tušar, Iztok Arčon, Alenka Ristić, Aleksander Rečnik, Venčeslav Kaučič
Synthesis and structural properties of titanium containing microporous/mesoporous silicate composite (Ti, Al)-Beta/MCM-48
In: , Vol. 99, no. 1/2, pp. 3–13, 2007.
24. Witold Mielcarek, Slavko Bernik, Krystyna Prociów
Relations between the morphology of ZnO powders and the electrical performance of ZnO varistors
In: Refereed Reports The Fourth China International Conference on High-Performance Ceramics (CICC-4), October 23–26, 2005, Chengdu, Sichuan Province, China (Key engineering materials, vol. 336–338, 2007), [S. l., s. n.], 2007, Vol. 336–338, pp. 672–675, 2007.
25. Saša Novak, Mitjan Kalin, P. Lukas, G. Anne, Jozef Vleugels, Omer Van der Biest
The effect of residual stresses in functionally graded alumina-ZTA composites on their wear and friction behaviour
In: J. Eur. Ceram. Soc., Vol. 27, pp. 151–156, 2007.
26. Saša Novak, Janez Kovač, Goran Dražić, Josè Marija Fonte Ferreira, S. Quaresma
Surface characterisation and modification of submicron and nanosized silicon carbide powders
In: J. Eur. Ceram. Soc., Vol. 27, pp. 3535–3550, 2007.
27. Matjaž Panjan, Sašo Šturm, Peter Panjan, Miha Čekada
TEM investigation of TiAlN/CrN multilayer coatings prepared by magnetron sputtering
In: Surf. coat. technol., Vol. 202, pp. 815–819, 2007.
28. Benjamin Podmiljšak, Paul J. McGuiness, Kristina Žužek Rožman, Barbara Novosel, Stane Pejovnik, Spomenka Kobe
The effects of nitriding on the magnetic properties of Sm-Fe- and Sm-Fe-Ta-based materials
In: J. alloys compd., Vol. 433, pp. 256–260, 2007.
29. Ioannis Raptis, Janez Kovač, Margarita Chatzichristidi, Evangelia Sarantopoulou, Zoe Kollia, Spomenka Kobe, Alciviadis-Constantinos Cefalas
Enhancement of sensing properties of thin poly(methyl methacrylate) films by VUV modification
In: J. laser micro nanoeng., Vol. 2, no. 3, pp. 200–205, 2007.
30. Boriana Rashkova, Sašo Šturm, (10 authors)
Combined ab-initio and N-K, Ti-L_{2,3}, V-L_{2,3} electron energy-loss near edge structure studies for TiN and VN films
In: Int. j. mater. res., Vol. 98, no. 11, pp. 1060–1065, 2007.

31. Aleksander Rečnik, Nina Daneu, Slavko Bernik
Nucleation and growth of basal-plane inversion boundaries in ZnO
In: J. Eur. Ceram. Soc., Vol. 27, no. 4, pp. 1999-2008, 2007.
32. Zoran Samardžija, Jae-ho Jeon, Miran Čeh
Microstructural and compositional study of a bulk $Pb(Mg_{1/3}Nb_{2/3})O_3PbTiO_3$ single crystal grown from a $BaTiO_3$ seed
In: Mater. charact., Vol. 58, pp. 534-543, 2007.
33. Evangelia Sarantopoulou, K. Gatsouli, Zoe Kollia, Stergios Pispas, Spomenka Kobe, Janez Kovac
Micro/nano self-assembled 2D structures of block copolymer/Fe hybrids
In: Phys. status solidi, a Appl. res., Vol. 204, no. 6, pp. 1835-1842, 2007.
34. Evangelia Sarantopoulou, Zoe Kollia, Alciviadis-Constantinos Cefalas, A. M. Douvas, Margarita Chatzichristidi, P. Argitis, Spomenka Kobe
Polymer self-assembled nano-structures and surface relief gratings induced with laser at 157 nm
In: Appl. surf. sci., Vol. 253, pp. 7884-7889, 2007.
35. Evangelia Sarantopoulou, Zoe Kollia, Alciviadis-Constantinos Cefalas, A. M. Douvas, Margarita Chatzichristidi, P. Argitis, Spomenka Kobe
Nano-scale spatial control over surface morphology of biocompatible fluoropolymers at 157 nm
In: Mater. sci. eng., C, Biomim. mater., sens. syst., Vol. 27, issues 5-8, pp. 1191-1196, 2007.
36. Evangelia Sarantopoulou, C. P. E. Varsamis, Zoe Kollia, Alciviadis-Constantinos Cefalas, Janez Kovac, Spomenka Kobe
VUV light induced surface interaction and accelerated diffusion of carbon, silicon, oxygen and other contaminants in LiF crystals
In: Laser synthesis and processing of advanced materials: E-MRS 2007 symposium, Strasbourg, France, May 28th - June 1st, 2007, Applied surface science, Amsterdam, Elsevier, 2007, Vol. 254, no. 4, pp. 804-810, 2007.
37. Srećo Škapin, Goran Dražić, Zorica Crnjak Orel
Microstructure of nanoscale zinc oxide crystallites
In: Mater. lett., Vol. 61, no. 13, pp. 2783-2788, 2007.
38. Irena Škulj, Andraž Kocjan, Paul J. McGuiness, Borivoj Šuštaršič
Hydrogen absorption by Ti-Zr-Ni-based alloys
In: Mater. tehnol., Vol. 41, No. 6, pp. 279-282, 2007.
39. Drago Torkar, Sašo Novak, Franc Novak
Apparent viscosity prediction of alumina-paraffin suspensions using artificial neural networks
In: J. mater. process. technol., [in press] 2007.
40. H. L. Tsai, T. Y. Wang, J. R. Yang, C. C. Chuo, Jung-Tsung Hsu, Miran Čeh, Makoto Shiojiri
Structural analysis of strained p-type AlGaN/GaN superlattice
In: J. appl. phys., Vol. 101, no. 2, pp. 023521-1-023521-6, 2007.
41. Xian-Hao Wang, Hui Gu, Qing-Wei Huang, Miran Čeh
Cation occupancy at the A1/A2 sites in strontium barium niobate micro-crystals grown from molten NaCl and KCl salts
In: Acta mater., Vol. 55, no. 16, pp. 5303-5674, 2007.
42. Anton Zalar, Janez Kovac, Borut Praček, Peter Panjan, Miran Čeh
Ion sputtering rates of Cr, Cr_x, and Cr at different Ar⁺ ion incidence angles
In: Vacuum, Vol. 82, no. 2, pp. 116-120, 2007.
43. Milan Žunić, Zorica Branković, Slavko Bernik, M. S. Góes, Goran Branković
ZnO varistors from intensively milled powders
In: J. Eur. Ceram. Soc., Vol. 27, pp. 3897-3900, 2007.
44. Kristina Žužek Rožman, Andreas Krause, Karin Leistner, Sebastian Fähler, Ludwig Schultz, Heike Schlörb
Electrodeposition and hard magnetic properties of Co-Pt films in comparison to Fe-Pt films
In: J. magn. magn. mater., Vol. 314, pp. 116-121, 2007.
45. Ines Bračko, Boštjan Jančar, Sašo Šturm, Danilo Suvorov
Razumevanje nastanka nanostrukturnega perovskita $CaTiO_3$ pod hidrotermalnimi pogojimi
In: Mater. tehnol., Vol. 41, No. 6, p. 317, 2007.
46. Kristina Žagar, Sašo Šturm, Miran Čeh
Sinteza in karakterizacija perovskitnih nanopalčk
In: Mater. tehnol., Vol. 41, No. 6, pp. 307-309, 2007.
6. Aleš Podgornik, Aleksander Rečnik, Renata Marjetič
Kristali soli iz Sečoveljskih solin
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 372-379.
7. Vili Podgoršek, Franc Golob, Aleksander Rečnik, Tadej Dolenc, Ana Hinterlechner-Ravnik
Minerali pegmatitnih žil in aplskih razpolok pri Cežlaku na Pohorju
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 273-283.
8. Vili Podgoršek, Franc Golob, Aleksander Rečnik, Ana Hinterlechner-Ravnik
Minerali medplastihrni in aplski razpolok v metamorfnih kamninah v Koritnem na Oplotnico
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 284-295.
9. Vili Podgoršek, Aleksander Rečnik
Mineralno bogastvo Haloz. III., Dobrina
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 250-268.
10. Vili Podgoršek, Janez Zavašnik, Saša Zavadlav, Aleksander Rečnik
Nahajališče epidota v Frajhajmu na Pohorju
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 331-344.
11. Aleksander Rečnik
Pegmatitni minerali Tolstega vrha pri Ravnah na Koroškem
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 10-16.
12. Aleksander Rečnik
Klasično nahajališče kremenovih kristalov na Črnem Vru pri Polhovem Gradcu
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 67-75.
13. Aleksander Rečnik
Conarni in akvarjasti kristali kremena z Zagradišča pri Sostrem
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 89-100.
14. Aleksander Rečnik
Najdba rožnatega apatita v aplskih razpokah nad Krašnjo
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 169-171.
15. Aleksander Rečnik
Alpske razpole s kremenom in rutilom nad Krašnjo
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 172-193.
16. Aleksander Rečnik, Nina Daneu
Kristali kremena in arzenopirita z Znojil pri Trojanaš
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 140-150.
17. Aleksander Rečnik, Nina Daneu, Janez Zavašnik, Tadej Dolenc
Dvojčki pirita "železni križ" s Katarine nad Ljubljano
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 355-367.
18. Aleksander Rečnik, Franc Golob, Vili Podgoršek
Minerali v karbonskih skrilavih glinavilih med Trojanami in Ljubljano
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 151-167.
19. Aleksander Rečnik, Franc Golob, Vili Podgoršek, Uroš Herlec
Minerali Bistrškega vintgarja na južnem Pohorju
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 306-311.
20. Aleksander Rečnik, Majda Gradišar, Breda Mirtič
Minerali pegmatitnih gnezd v dolini Velike Polskave
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 312-330.
21. Aleksander Rečnik, Željko Habl
Nahajališča kremenovih kristalov na Hrastniku pri Škofji Loki
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 76-87.
22. Aleksander Rečnik, Uroš Herlec
Dobrova pri Dravogradu - locus typicus minerala dravita
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 17-21.
23. Aleksander Rečnik, Uroš Herlec, France Staré
Geneza in značilnosti nahajališča kremenovih kristalov pri Crnogrobu
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 40-50.
24. Aleksander Rečnik, Andreja Kralj, Aleš Podgoršek, Breda Mirtič
Minerali septarij pri Zgornjem Štrihovcu v Slovenskih Goricah
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 121-137.
25. Aleksander Rečnik, Vili Podgoršek, Franc Golob, Uroš Herlec
Ametist in rudni minerali v medplastihrnih razpokah na Okoški gori
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 296-305.

REVIEW ARTICLES AND CHAPTERS IN BOOKS

1. Tadej Dolenc, Aleksander Rečnik
Mineralizirane alpske razpole na področju Žirovskega vrha
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 53-59.
2. Franc Golob, Aleksander Rečnik
Mineralno bogastvo Haloz. I., Dobrška gora
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 236-240.
3. Franc Golob, Aleksander Rečnik
Mineralno bogastvo Haloz. II., Strganca
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 241-249.
4. Blaž Miklavič, Aleksander Rečnik, Goran Schmidt
Markazitno-piritne konkrekcije z Matujurja
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 345-354.
5. Vojko Pavčič, Aleksander Rečnik
Kristali kalciita iz Kurje doline in Udiranja nad Kamniško Bistroč
In: Nahajališča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 103-107.

26. Aleksander Rečnik, Vili Podgoršek, Zmago Žorž
Granati iz skarnov na Kopah na Pohorju
In: Nahajaliča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 22-28.
27. Aleksander Rečnik, Rafael Šerjak, Renato Vidrih, Vesna Mikuž
Nahajaliča kremenovih "diamantov" v okolici Cerknice
In: Nahajaliča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 219-236.
28. Aleksander Rečnik, Vesna Šrot, Breda Mirtič
Fluoritna mineralizacija na severnih pobočjih Blegoša
In: Nahajaliča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 29-39.
29. Aleksander Rečnik, Janez Zavašnik
Biterminirani kristali kremena iz okolice Turjaka. I., Osolniška prelomna cona
In: Nahajaliča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 194-205.
30. Aleksander Rečnik, Janez Zavašnik
Biterminirani kristali kremena iz okolice Turjaka. II., Medvediška prelomna cona
In: Nahajaliča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 206-218.
31. Goran Velikonja, Aleksander Rečnik
Kristali kremena iz permskih peščenjakov pri Sovodnju
In: Nahajaliča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 60-66.
32. Renato Vidrih, Aleksander Rečnik
Nahajaliče pirita v Dolžanova soteski nad Tržičem
In: Nahajaliča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 108-114.
33. Saša Zavadlav, Janez Zavašnik, Aleksander Rečnik, Vladimir Bermanec, Tadej Dolenc
Kristali azurita s Počivalniku nad Dolžanovom sotesko
In: Nahajaliča mineralov v Sloveniji, Aleksander Rečnik, ed., Ljubljana, Institut Jožef Stefan, Odsek za nanostrukturne materiale, 2007, pp. 115-120.
5. Benjamin Podmiljšak, Paul J. McGuiness, Irena Škulj, Boštjan Markoli, Goran Dražić, Spomenka Kobe
A microstructural investigation of $Gd_x(Si_{1-x})_4$ alloys produced
In: 2nd International Conference on Magnetic Refrigeration at Room Temperature: proceedings, commissions B2, A1 with E2: comptes rendus, commissions B2, A1 with E2, Portorož, Slovenia, 11-13 April 2007 (Science et technique du froid, 2007-1), Alojz Poredos, ed., Alen Šarlak, ed., Paris, Institut International du Froid, 2007, pp. 145-153.
6. Zoran Samardžija, Miran Čeh, Jae-ho Jeon
Quantitative WDXS analysis of PMN-PT single crystal
In: Proceedings, 8th Multinational Congress on Microscopy, June 17-21, 2007, Prague Czech Republic, Jana Nebešářová, ed., Pavel Hozák, ed., [Prague], Czechoslovak Microscopy Society, cop. 2007, pp. 103-104.
7. Christina Scheu, L. M. Cha, Sašo Šturm, Harald F. Chladil, Paul H. Mayrhofer, Helmut Clemens, Walter Wolf, Raimund Podloucky
Structure models of massively transformed high niobium containing TiAl alloys:
[presented at Advanced Intermetallic-Based Alloys, November 27-30, 2006, Boston, MA]
In: Mater. Res. Soc. symp. proc., Vol. 980, pp. 0980-II05-1-0980-II05-6, 2007.
8. Sašo Šturm, Boštjan Jančar, Ines Bračko
Towards understanding the hydrothermal synthesis of nanostructured $CaTiO_3$: HRTEM and EELS study
In: Proceedings, 8th Multinational Congress on Microscopy, June 17-21, 2007, Prague Czech Republic, Jana Nebešářová, ed., Pavel Hozák, ed., [Prague], Czechoslovak Microscopy Society, cop. 2007, pp. 165-166.
9. Tea Toplišek, Goran Dražić, Saša Novak, Spomenka Kobe
Microanalysis of SiC/SiC composite material
In: Proceedings, 8th Multinational Congress on Microscopy, June 17-21, 2007, Prague Czech Republic, Jana Nebešářová, ed., Pavel Hozák, ed., [Prague], Czechoslovak Microscopy Society, cop. 2007, p. 317.
10. Polona Umek, Matjaž Pregelj, Alexandre Gloter, Pavel Cevc, Miran Čeh, Urša Pirnat, Denis Arčon
Titanate nanostructures doped with Cu^{2+} ions: EPR and TEM characterization
In: Engineering of crystalline materials properties: state-of-the-art in modelling, design, applications, lecture notes and poster abstracts, 39th Course, a Nato Advanced Study Institute, Erice, Italy, 7 to 17 June 2007, Lia Addadi, ed., Juan Novoa, ed., Dario Braga, ed., Erice, International School of Crystallography, 2007, Zv. 2, pp. 646-647.
11. Kristina Žagar, Sašo Šturm, Miran Čeh
Template-assisted synthesis and characterization of $BaTiO_3$ nanorods
In: Proceedings, 8th Multinational Congress on Microscopy, June 17-21, 2007, Prague Czech Republic, Jana Nebešářová, ed., Pavel Hozák, ed., [Prague], Czechoslovak Microscopy Society, cop. 2007, pp. 323-324.

PUBLISHED CONFERENCE PAPERS

Invited Paper

1. Miran Čeh, Sašo Šturm, Makoto Shiojiri
Influence of Debye-Waller factor on atom column intensity calculations in HR HAADF-STEM imaging
In: Proceedings, 8th Multinational Congress on Microscopy, June 17-21, 2007, Prague Czech Republic, Jana Nebešářová, ed., Pavel Hozák, ed., [Prague], Czechoslovak Microscopy Society, cop. 2007, pp. 33-36.

Regular Papers

1. Sabina Beranič, Milan Ambrožič, Tomaž Kosmač, Saša Novak
Tunneling cracks in $Al_2O_3/Al_2O_3/ZrO_2$ layered composites
In: Refereed reports of IX Conference & Exhibition of the European Ceramic Society: 19-23 June 2005, Portorož, Slovenia, Journal of the European ceramic society, Marijeta Maček, ed., Danilo Suvorov, ed., Amsterdam, Elsevier, 2007, Vol. 27, no. 2/3, pp. 1333-1337, 2007.
2. Nina Daneu, Aleksander Rečnik, Herbert Schmid, Werner Mader
The atomic structure of (301) twins of rutile from diamantina (Brazil)
In: Proceedings, 8th Multinational Congress on Microscopy, June 17-21, 2007, Prague Czech Republic, Jana Nebešářová, ed., Pavel Hozák, ed., [Prague], Czechoslovak Microscopy Society, cop. 2007, pp. 147-148.
3. Medeja Gec, Vesna Šrot, Jae-ho Jeon, P. A. Aken, Miran Čeh
Comparison of chemical composition of PMN-PT thin foils prepared by ion-milling and wedge preparation technique
In: Proceedings, 8th Multinational Congress on Microscopy, June 17-21, 2007, Prague Czech Republic, Jana Nebešářová, ed., Pavel Hozák, ed., [Prague], Czechoslovak Microscopy Society, cop. 2007, pp. 251-252.
4. Boštjan Markoli, Paul J. McGuiness, Benjamin Podmiljšak, Irena Škulj, Spomenka Kobe
The synthesis of a magneto-caloric GD5 (GESI)4 alloy by arc melting
In: Proceedings, International 47th Foundry conference, 12-14 September 2007, Portorož, Slovenia, [Ljubljana], Društvo livarjev Slovenije, [2007], pp. 1-10.

INTERNATIONAL PROJECTS

1. Development of Functional Material for Insulating Flow Channel Inserts (Ceramic Processing of SiC Composites for Functional Applications) - UT1-FU
EURATOM - MHEST, 7. FP, Slovenian Fusion Association - SFA
Annex No. 2, 3211-05-000017, FU06-CT-2004-00083
EC; RS, Ministry of Higher Education, Science and Technology, Ljubljana, Slovenia
Asst. Prof. Saša Novak Krmpotič, Asst. Prof. Goran Dražić
2. Development of Composites with Advanced/Alternative Manufacturing Concepts: Vacuum Slip Infiltration of SiC/SiC - UT2-FU
EURATOM - MHEST, 7. FP, Slovenian Fusion Association - SFA
Annex No. 2, 3211-05-000017, FU06-CT-2004-00083

THESES

Ph. D. Thesis

1. Zoran Samardžija
Electron probe microanalysis of doped perovskite ceramics
(Asst. Prof. Miran Čeh, Prof. Anton Zalar)

B. Sc. Theses

1. Simona Ovtar
Evaluation of amorphous phase in SiC-based samples by X-ray diffraction
(Asst. Prof. Saša Novak Krmpotič, Prof. Anton Meden)
2. Mitja Škalč
Synthesis and characterization of $BaTiO_3$ nanorods
(Asst. Prof. Miran Čeh, Asst. Prof. Boštjan Markoli)

PATENT APPLICATIONS

1. Paul J. McGuiness, Gregor Geršak, Spomenka Kobe, Tool for measuring magnetic properties at high temperatures: US patent 500228052A. Washington: United States Patent and Trademark Office, 2007.
2. Saša Novak, Katja König, Stojana Veskovčiuk Bukudur, A method for hydrophobisation of a ceramic powder by applying an organic coating in an aqueous suspension: patent application no. WO 2007/084084 A2. [S.]: World Intellectual Property Organization, 2007.

EC; RS, Ministry of Higher Education, Science and Technology, Ljubljana, Slovenia
Asst. Prof. Goran Dražić, Asst. Prof. Saša Novak Krmpotič

3. Research Unit - Administration and Services - RU-FU
EURATOM - MHEST, 7. FP, Slovenian Fusion Association - SFA
Annex No. 2, 3211-05-000017, FU06-CT-2004-00083
EC; RS, Ministry of Higher Education, Science and Technology, Ljubljana, Slovenia
Asst. Prof. Saša Novak Krmpotič, Prof. Milan Čerček
4. Multifunctional Bioreversible Biocompatible Coatings with Biofilm Inhibition and Optimal Implant Fixation
6. FP, MEDDELCOAT, NMP3-CT-2006-026501
EC; Prof. Jozef Vleugels, Katholieke Universiteit Leuven, Research & Development, Leuven, Belgium
Asst. Prof. Saša Novak Krmpotič

5. Enabling Science and Technology through European Electron Microscopy
ESTEEM, 6. FP, 026019
EC; Prof. Gustaaf Van Tendeloo, Universiteit Antwerpen, Antwerpen, Belgium
Asst. Prof. Miran Čeh, Dr. Sašo Šturm
6. Complex Metallic Alloys
CMA, 6. FP, NMP3-CT-2005-500140
EC; Centre National de la Recherche Scientifique, Paris, France
Prof. Spomenka Kobe, Prof. Janez Dolinsk, Dr. Peter Panjan
7. Strengthening the Role of Women Scientists in Nano-Science
WOMENINNANO, 6. FP, SAS6, 016754
EC; Dr. Annett Gebert, IFW Dresden, Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden E.V., Dresden, Germany
Prof. Spomenka Kobe
8. Development of Ceramic Matrix Composite for Advanced Nuclear Applications, with an SiC Continuous Fiber Reinforcement and a Nanostructured Carbide Matrix, Processes by the Electrolytic Infiltration
1000-07-380046
Dr. Jérôme Cane, Commissariat à l'énergie atomique - CEA Saclay, Gif-sur-Yvette, France
Asst. Prof. Saša Novak Krmpotić
9. SiC Coating for Hybrid Thermal Protection Systems for ESA
Subcontract Agreement
Dr. George Vekinis, The National Centre of Scientific, Research "Demokritos", Aghia Paraskevi, Athens, Greece
Asst. Prof. Saša Novak Krmpotić
10. Fuel Storage Nano-Composites Fabricated by Pulse Laser Deposition - PLD
BI-GR-04-06-019
Prof. A. C. Cefalas, National Hellenic Research Foundation, Theoretical and Physical Chemistry Institute, Athens, Greece
Prof. Spomenka Kobe
11. Precipitation of Calcium Carbonate in the Magnetic Field
BI-HR/05-06-031
Dr. Sc. Damir Kralj, Rudjer Bošković Institute, Zagreb, Croatia
Prof. Spomenka Kobe
12. Influence of Quantum Effects on Vibrational Properties of Nano-crystalline Silicon
BI-HR/07-08-028
Dr. Davor Gracin, Rudjer Bošković Institute, Zagreb, Croatia
Asst. Prof. Miran Čeh
13. Hydrogen Storage in Ni-Ti-Zr-Hf Quasicrystals
BI-HR/06-07-020
Dr. Muhamet Sučeska, Dr. Maša Rajić Linarić, Brodarski Institut, Laboratorij za termičku analizu, Zagreb, Croatia
Dr. Paul McGuiness
14. Study of Remodelling of Bone-ceramic Interface to Assess Cell Growth Kinetics as a Function of Composition and Morphological Modification of Ceramic Implant
BI-IN/06-07-009
Prof. Basu Debabrata, Central Glass & Ceramic Research Institute, Calcutta, India
Dr. Nina Danau
15. Structural and Chemical Characterization of Titanate-based Nanorods and Nanotubes
BI-CN/07-09-006
Prof. Hui Gu, Shanghai Institute of Ceramics, Shanghai, China
Asst. Prof. Miran Čeh
16. Electronic Ceramics with Interface Control of Electrical Properties
BI-CN/05-07-006
Prof. Hui Gu, Shanghai Institute of Ceramics, Shanghai, China
Asst. Prof. Miran Čeh
17. Environmental Hydrogen-based Recycling of Nd-Fe-B Magnets
BI-CN/05-07-008
Dr. Gaolin Yan, Harbin Institute of Technology, Shenzhen Graduate School, Xili, Shenzhen, China
Dr. Paul McGuiness
18. Low Pressure Injection Molding of Near-Net Shaped Piezoelectric Ceramics
U3-MM/K6-06-028
Dr. Jae-Ho Jeon, Korea Institute of Machinery and Materials (KIMM), Ceramic Materials Group, Sangnam-Dong, Changwon, Korea
Asst. Prof. Miran Čeh, Prof. Tomaž Kosmač
19. Development of Single Crystalline and Electroceramic Materials by Sintering Process
BI-TR/05-08-002
Prof. Mehmet Ali Gülgün, Sabancı Üniversitesi, Orhanlı Tuzla, İstanbul, Turkey
Asst. Prof. Miran Čeh
20. Texturing and Characterisation of ZnO-based Ceramics
BI-TR/05-08-003

Prof. Ender Suvaci, Anadolu University, Department of Materials Science and Engineering, Eskisehir, Turkey
Dr. Slavko Bernik

R & D GRANTS AND CONTRACTS

1. Layered ceramic nanostructures and 2D nanoparticles arrays
Asst. Prof. Miran Čeh
2. Fabrication of novel thin films by pulser-laser ablation with in situ ICP-MS analysis of target plumes for deposition control
Prof. Spomenka Kobe
3. Nanostructural engineering of semiconducting materials
Dr. Aleksander Rečnik
4. The influence of magnetic structure of the materials on the magnetocaloric effect
Dr. Matej Komelj
5. Exploration and preservation of Slovenian mineralogical heritage
Dr. Aleksander Rečnik
6. Application of new technologies to prevent scaling in industrial flow systems
Prof. Spomenka Kobe
7. Rare-earth-transition-metal alloys for high-energy permanent magnets and metal-hydride batteries
Dr. Paul McGuiness
8. Research of degradation mechanisms and improvement of properties of metallized film capacitors
Asst. Prof. Miran Čeh
9. Low-doped ZnO-based ceramics for energy varistors
Dr. Slavko Bernik
10. Development of tissue engineered bone for use in periodontology, traumatology and orthopaedic surgery
Asst. Prof. Miran Čeh
11. Hard magnetic Co-Pt thin films produced with electrodeposition
Prof. Spomenka Kobe, Dr. Kristina Žužek Rožman
12. A development of low-activation material for the first wall in fusion reactor
Asst. Prof. Saša Novak Krmpotić
13. Ecotechnological 1D nanomaterials: Synthesis and characterisation of 1D titanate nanomaterials doped with transition metal ions
Dr. Sašo Šturm, Dr. Polona Umek
14. New generation of elements and devices for protection against transient surges (CoE Materials for electronics of next generation and other emerging technologies)
Dr. Slavko Bernik
15. Magnetic materials and intermetallic alloys (CoE Materials for electronics of next generation and other emerging technologies)
Prof. Spomenka Kobe
16. Nanostructured surfaces and interfaces (CoE Nanosciences and nanotechnologies)
Asst. Prof. Goran Dražić
17. Characterization on the nanometric scale (CoE Nanosciences and nanotechnologies)
Asst. Prof. Miran Čeh

RESEARCH PROGRAM

1. Nanostructured materials
Prof. Spomenka Kobe

NEW CONTRACTS

1. Cooling systems based on magneto-caloric effect
PROKOL d.o.o., Idrija
Prof. Spomenka Kobe
2. Low-doped ZnO-based ceramics for energy varistors
Iskra Zaščite d.o.o., Ljubljana
Dr. Slavko Bernik
3. Low-doped ZnO-based ceramics for energy varistors
Varsi, d.o.o., Ljubljana
Dr. Slavko Bernik
4. VIZIPIN: A safe infrastructure for command and control
Varsi, d.o.o., Ljubljana
Dr. Slavko Bernik

VISITORS FROM ABROAD

1. Karl Höhener, Dipl. Eng., Annemarie Gemperli, MBA, Temas AG, Arbon, Switzerland, 30 January 2007
2. Dr. George Vekinis, Advanced Ceramic Laboratory, Institute for Materials Science, National Center for Scientific Research "Demokritos", Athens, Greece, 9 February 2007
3. Ilaria Corni, Dr. Oana Bretcanu, Department of Materials, Imperial College London, London, United Kingdom, 25 March – 1 April 2007

4. Dr. Damir Kralj, Institut Rudjer Bošković, Zagreb, Croatia, 20 April 2007
5. Dr. Mehmet Ali Gülgün, Sabancı University, Istanbul, Turkey, 3 – 10 May 2007
6. Dr. Goran Branković (4 June – 30 November 2007) and Dr. Zorica Branković (8 June – 1 September 2007), Ms. Milica Počuća (4 – 16 June 2007), Centar za multidisciplinarnе studije, Univerzitet u Beogradu, Belgrade, Serbia
7. Dr. Andreja Gajović, Institut Rudjer Bošković, Zagreb, Croatia, 3 April 2007 – 31 March 2008
8. Dr. Boriana Rashkova, Erich Smid Institut für Materialwissenschaft und Montanuniversität Leoben, Leoben, Austria, 11 – 13 July 2007

9. Dr. Mithlesh Kumar Sinha (30 July - 14 August 2007) Dr. Jui Chakraborty (30 July - 28 September 2007) Central Glass & Ceramic Research Institute, Calcutta, India
10. Dr. George Vekinis, Advanced Ceramic Laboratory, Institute for Materials Science, National Center for Scientific Research "Demokritos", Athens, Greece, 23 - 26 August 2007
11. Dr. Jae-Ho Jeon, Korea Institute of Machinery and Materials - KIMM, Changwon-city, Kyeongnam, South Korea, 1 - 5 September 2007
12. Dr. Ender Suvaci, Anadolu University, Department for Materials Science and Engineering, Eskisehir, Turkey, 2 - 6 September 2007
13. Prof. Jozef Vleugels, Prof. Omer Van der Biest, Tina Mattheys and Prof. Lieve Van Mellaert, Katholieke Universiteit Leuven, Leuven, Belgium, Dr. Monika Willert-Porada, Dr. Thorsten Gerdes, Andrea Rosin and Elke Fuchs, Universität Bayreuth, Bayreuth, Germany, Jordi Garcia-Forga, Peyer Fertigungstechnik AG, Waltenschwil, Switzerland, Prof. Pieter Luypaert, Microwave Energy Applications Company NV, Leuven, Belgium, Dr. Martin Erdtmann, HEMOTEQ GmbH, Würselen, Germany, Prof. V. Spitas, Institute of Mechanics of Materials and Geostructures - IMMG SA, Penteli, Greece, Prof. Michael Gasik, Helsinki University of Technology, Espoo, Finland, Dr. Alessandro Facchini and Dr. Michele Pressacco, LIMA-LTO S.P.A., S. Daniele D.F., Italy, Barbara Lebar-Rjazancev, Marko Gradišar and Katja Kolman, HELI PRO d.o.o., Lesce, Slovenia, Dr. Nevenka Kregar-Velikonja and Dr. Hana Krečič Stres, EDUCELL, Ljubljana, Slovenia, Matej Andoljšek, Dr. Med, General Hospital Jesenice, Jesenice, Slovenia, Dr. Maja Remškar, Dept. Condensed Matter Physics, Jožef Stefan Institute, Ljubljana, Slovenia, 20 - 21 September 2007
14. Prof. Gerhard Dehm and Daniel Kiener, Erich Smid Institut für Materialwissenschaft und Montanuniversität Leoben, Leoben, Austria, 27 - 28 September 2007
15. Dr. Ulrike Wolff, Leibniz-Institut für Festkörper- und Werkstoffforschung, Dresden, Germany, 13 - 16 November 2007
16. Dr. Petr Klouček, Institut de Mathématiques, Université de Neuchâtel, Neuchâtel, Switzerland, 19 - 21 November 2007
17. Dr. Thierry Sikora, Centre d'Elaboration de Matériaux et d'Etudes Structurales, Toulouse, France, 4 - 6 December 2007
18. Dr. Davor Gracin, Institut Rudjer Bošković, Zagreb, Croatia, 6 December 2007
19. Dr. Jérôme Canel and Dr. Aurélie Coupe, Commissariat à l'Energie Atomique - CEA Saclay, DEN/DMN/SRMA/LTMEX, Gif-sur-Yvette, France, 17 - 18 December 2007
20. İsmail Özgür Özer, Anadolu University, Department for Materials Science and Engineering, Eskisehir, Turkey, 16 - 23 December 2007

STAFF

Researchers

1. Dr. Slavko Bernik**
2. Asst. Prof. Miran Čeh**
3. Dr. Nina Daneu
4. Asst. Prof. Goran Dražić**
- 5. Prof. Spomenka Kobe**, Head**
6. Dr. Matej Komelj**
7. Asst. Prof. Paul John McGuiness
8. Asst. Prof. Saša Novak Krmpotić**
9. Dr. Aleksander Rečnik**
10. Dr. Sašo Šturm

Postdoctoral associates

11. Dr. Vesna Šrot, left 1.2.2007
12. Dr. Kristina Žužek Rožman

Postgraduates

13. Nataša Drnovšek, B. Sc.
14. Andraž Kocjan, B. Sc.
15. Katja König, B. Sc.
16. Blaž Miklavčič, B.Sc.
17. Katarina Rade, B.Sc.
18. Tea Toplišek, B. Sc.
19. Kristina Žagar, B. Sc.

Technical officers

20. Sanja Fidler, univ. B. Sc.
21. Medeja Gec, B. Sc.
22. David Jezeršek, B. Sc., left 30. 9. 2007
23. Matejka Podlogar, B. Sc.
24. Benjamin Podmiljšak, B. Sc.
25. Dr. Zoran Samardžija

** Part-time faculty member