KR 12: Functional Materials - Analysis with EBSD, X-Ray Kossel Diffraction and Related Methods (MI jointly with KR)

Time: Thursday 9:30–11:00 Location: MER 02

Invited Talk KR 12.1 Thu 9:30 MER 02

The martensitic transformation in Co-Ni-Al F-SMA — •Jaromír Kopeček[1], Karel Jurek[1], Michal Landa[2], and Oleg Heczko[1] — [1]Institute of Physics ASCR, Praha, Czech Republic — [2]Institute of Thermomechanics ASCR, Praha, Czech Republic

The Co-Ni-Al alloys were in the focus of physicist from the beginning of research in ferromagnetic shape memory alloys, but as the surprisingly higher and higher magnetic field induced strain due to reorientation or transformation in magnetic field were announced in Ni-Mn-Ga system, the more dubious results emerged for the Co-Ni-Al system. It seemed apparent that Co-based shape memory alloys would quickly return into the structural intermetallics, interesting, complicated and useful, but just as another superalloy. Despite the knowledge accumulated in literature, recently researchers in this field were frustrated by curious disagreement between optical observation showing martensite lamellae at room temperature while magnetic measurement indicates that the martensitic transformation is well below zero. The present work compiled the results of various methods, which - we believe - proved that the martensitic transformation temperature in $Co_{38}Ni_{33}Al_{29}$ is around -70 °C, whereas all higher temperature features are examples of stress induced transformation. Using various microscopies including EBSD together with RUS, magnetic measurements and mechanical testing we were able to explain the evolution of the structure. In comparison with Ni-Mn-Ga systems there are marked differences in transformation path which ultimately may explain why we cannot expect the magnetic shape phenomena in Co-Ni-Al alloys.

KR 12.2 Thu 10:00 MER 02

Charakterisierung flächenhafter Inhomogenitäten in der ferromagnetischen Formgedächtnislegierung $Co_{38}Ni_{33}Al_{29}$ mittels Kossel- und Pseudo-Kossel-Technik — Enrico Langer[1,2], Siegfried Däbritz[1], •Leonid P. Potapov[1], Katerina Kratka[1] und Jaromír Kopeček[3] — [1]Technische Universität Dresden, Institut für Festkörperphysik, 01062 Dresden, Germany — [2]Technische Universität Dresden, Institut für Halbleiter- und Mikrosystemtechnik, 01062 Dresden, Germany — [3]Academy of Sciences of the Czech Republic, Insitute of Physics, 18222 Prague, Czech Republic

Die Legierung $Co_{38}Ni_{33}Al_{29}$ weist unter den ferromagnetischen Formgedächtnissystemen besonders gute werkstoffphysikalische Eigenschaften auf, wie beispielsweise gute Korrosionsbeständigkeit und ausgeprägte Duktilität. Beobachtete flächenhafte Inhomogenitäten zeichnen sich im Rückstreuelektronenkontrast dunkel gegenüber der Probenmatrix aus und befinden sich innerhalb der B2-β-Phase des Austenit-Kristalls der ferromagnetischen Legierung. Insbesondere heben sie sich als dunkle Ränder in der β-Phase nahe der Phasengrenze und als dunkle periodische Strukturen hervor.
Die Kossel-Technik liefert zur Charakterisierung dieser Gebiete aufschlussreiche Ergebnisse bezüglich der Kristallqualität. Es zeigt sich erstens, dass die genannten Randstrukturen eine exakte Ausrichtung nach der Kurdjumov-Sachs-Orientierungsrelation bestätigen und zweitens, dass die beobachtete Reflexüberlagerung in den A1- bzw. B2-Phasen die Kossel-Reflexe (111) und (002) beziehungsweise (110) und (011) betreffen. Außerdem besitzt die periodisch dunkle Struktur innerhalb der β-Phase eine komplizierte rechteckige Anordnung von Punkten, verbunden durch sehr feine Linien. Diese periodische Struktur richtet sich offensichtlich entlang der Kristallwachstumsrichtung [100] aus. Pseudo-Kossel-Aufnahmen bestätigen ebenfalls erfolgreich eine Kristallqualitätsverbesserung in den dunklen Gebieten, was sich durch eine lokale Verschärfung einzelner Interferenzreflexe vom Typ (110) äußerte.

KR 12.3 Thu 10:15 MER 02

Strain inhomogeneities in epitaxial $BaFe_2As_2$ thin films measured by cross correlation electron backscatter diffraction — •Paul Chekhonin[1], Jan Engelmann[2], Bernhard Holzapfel[2], Carl-Georg Oertel[1], and Werner Skrotzki[1] — [1]Institut für Strukturphysik, Technische Universität Dresden — [2]Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden

Epitaxial thin films of strained $BaFe_2As_2$ have been produced by pulsed laser deposition on a spinel substrate with an iron buffer layer. Using the cross correlation electron backscatter diffraction technique in a scanning electron microscope, relative measurements of very small strains and disorientations are possible. From electron backscatter diffraction pattern obtained on the $BaFe_2As_2$ layer partially strain relaxed areas were measured. Additionally, strain inhomogeneities and disorientations on length scales of few 100 nm and smaller have been detected.

KR 12.4 Thu 10:30 MER 02

Simulation of phase propagation delay for modulated EBIC in thin Silicon samples — •Markus Holla, Markus Ratzke, Winfried Seifert, and Martin Kittler — Joint Lab IHP/BTU, BTU Cottbus, Konrad-Wachsmann-Allee 1, 03046 Cottbus, Germany

Calculations of locally induced currents by a modulated electron beam are presented for thin Silicon samples with Schottky contacts. The theoretic electron beam current (EBIC) amplitudes and phase shifts are analyzed to estimate the influence of semiconductor parameters (such as surface recombination velocity, diffusion length and diffusion coefficient). The parameter identification limits for the method are discussed. Among other results it was found, that the phase shift correlates with the diffusion coefficient. The surface layer interaction and the resulting effective diffusion length behavior are presented, too.

KR 12.5 Thu 10:45 MER 02

Characterization of 0-3 high permittivity composite capacitors for energy storage — •Jens Glenneberg, Gerald Wagner, Thomas Grossmann, Stefan Ebbinghaus, Martin Diestelhorst, Sebastian Lemm, Horst Beige, and Hartmut Leipner — Martin-Luther-Universität Halle-Wittenberg

Energy storage is more than ever an important topic, while thin film capacitors with high energy densities seem to be a promising solution. Their advantages over accumulators are for example quick charging and discharging times, long lifetimes and low manufacturing costs.

Due to its ferroelectric properties and extremely high permittivity, $CaCu_3Ti_4O_{12}$ (CCTO) is well suited for the use in short term energy storage. Since pure CCTO exhibits comparatively low breakdown field strength, the device efficiency is limited. To increase the energy densities, CCTO nanoparticles can be embedded in specific inorganic matrices. The size and distribution of the nanoparticles determine the electric properties of the capacitor dielectrics to a very large extent.

To investigate the microstructure, the nanoparticles and the surrounding matrix are imaged by environmental scanning electron microscopy (ESEM) in both secondary electron contrast (SE) and backscattered electron contrast (BSE) as well as by transmission electron microscopy (TEM). To acquire compositional information, additional energy-dispersive X-ray spectroscopy (EDS) has been carried out. With the help of these investigations an assessment to the chemical composition and the microstructure is allowed, which can be seen in context to the resulting electrical properties.