MM 55: Mechanical Properties III

Time: Thursday 11:45–12:45 Location: TC 010

MM 55.1 Thu 11:45 TC 010

Microstructure and Texture in a Cu-Cr Alloy deformed by High Pressure Torsion — •Ksenia Kosyakova[1,2,3], Christine Tränkner[3], Aurimas Pukenas[3], Paul Chekhonin[3], Daria Shangina[1,2], Petr Straumal[1,2], Boris Straumal[2,4], Sergey Dobatkin[1,2], and Werner Skrotzki[3] — [1]A.A. Baikov Institute of Metallurgy and Materials Science of RAS, Moscow, Russia — [2]National University of Science and Technology "MISIS", Laboratory of Hybrid Nanostructured Materials, Moscow, Russia — [3]Institute of Structural Physics, Dresden University of Technology, Dresden, Germany — [4]Institute of Solid State Physics of RAS, Chernogolovka, Russia

The evolution of microstructure and texture in a Cu-0.7%Cr alloy deformed by high-pressure torsion (HPT) was examined depending on shear strain. Disks (diameter 10mm, thickness 0.6mm) were annealed at 600°C for 800h and HPT processed at room temperature under a hydrostatic pressure of 5 GPa for 0.5, 1, 3, 5 and 15 turns (max. shear strains 26, 52, 157, 262, 785). Electron backscatter and X-ray diffraction were applied at half-radius position for microstructure and texture analysis. After 5 rotations, a homogeneous ultrafine-grained structure is found with mean grain size of 190nm and predominance of high-angle boundaries. The texture consists of components typical for fcc-metals processed by simple shear deformation. Moreover, a new {1-14}<110> component is observed which is the main component for all shear strains. After 5 turns, the intensities of all components stay approximately the same.

MM 55.2 Thu 12:00 TC 010

Formation of Oblique Cube Component in Intermetallic Compounds Deformed by High Pressure Torsion — •Christine Tränkner[1], Aurimas Pukenas[1], Jelena Horky[2], Michael Zehetbauer[2], and Werner Skrotzki[1] — [1]Institute of Structural Physics, Dresden University of Technology, Dresden, Germany — [2]Physics of Nanostructured Materials, Faculty of Physics, University of Vienna, Vienna, Austria

NiAl, YCu and TiAl polycrystals with B2 and $L1_0$ structure, respectively, have been deformed by high pressure torsion at temperatures between 20°C and 500°C at a hydrostatic pressure of 8 GPa to high shear strains. Local texture measurements were done by diffraction of high-energy synchrotron radiation and X-ray microdiffraction. In addition, the microstructure was analyzed by electron backscatter diffraction. Besides typical shear components an oblique cube component is observed with quite large rotations about the transverse direction. Based on the temperature dependence of this component as well as to microstructure investigations it is concluded that it is formed by discontinuous dynamic recrystallization. The influence of high pressure on recrystallization of intermetallics at low temperatures is discussed.

MM 55.3 Thu 12:15 TC 010

Hot Isostatic Pressed Tungsten Fiber-Reinforced Tungsten — •Bruno Jasper[1], Jan W. Coenen[1], Johann Riesch[2], Till Höschen[2], and Christian Linsmeier[1] — [1]Forschungszentrum Juelich GmbH, IEK4 - Plasmaphysik, 52425 Jülich, Germany — [2]Max-Planck-Institut für Plasmaphysik, 85748 Garching, Germany

Tungsten fiber-reinforced tungsten (W_f/W) is a composite material that addresses the brittleness of tungsten (W) at low temperatures and after operational embrittlement, through extrinsic toughening by introducing crack energy dissipation mechanisms. Existing W_f/W samples produced via chemical vapor infiltration indeed showed higher toughness in mechanical tests than pure W. In this contribution W_f/W material specimens produced via powder metallurgical (PM) methods, e.g. hot isostatic pressing (HIP), are shown. A variety of measurements, e.g. 3-point bending and push-out tests, are presented to verify the operation of the expected toughening mechanisms. Therefore the focus of the investigations lies on the interface deboning behavior. In particular, the stability and integrity of the interface is investigated, since high temperatures (up to 1900 °C) and pressures (200 MPa) are present during the composite preparation. First HIP single-fiber samples indicate a compact matrix with densities of 99+ % of the theoretical density of W and showed signs of recrystallization and grain growth. SEM analysis demonstrates an intact interface with indentations of powder particles at the interface-matrix boundary. Push-out test results indicate that the structure of the interface may be damaged by HIPing since push-out of matrix elements is observed.

MM 55.4 Thu 12:30 TC 010

Aluminium-magnesium lightweight metal compound — •Enrico Knauer, Jens Freudenberger, and Ludwig Schultz — IFW Dresden Helmholtzstraße 20 01069 Dresden

Although the workability of magnesium is negligible under the conditions of rotary swaging, co-deformation of magnesium within a tube is possible. This process can be operated successfully up to a logarithmic deformation strain of at least 8, when utilizing an AA6082 tube. The microstructure of magnesium shows a decreasing grain size with increasing deformation strain, saturating at a grain size well below 5 *m. In addition, a preferential texture with a [1 010] ring fibre component is established during deformation. The evolution of the microstructure determines the mechanical properties of the composite, which is characterised by an ultimate tensile strength of 240 MPa. This corresponds to a specific strength of 104 MPa/(g/cm3).