MM 35: Liquid and Amorphous Metals II

Time: Wednesday 11:30–12:30 Location: H5

MM 35.1 Wed 11:30 H5

Effect of microstructure on the mechanical properties of metallic glasses — •Steffen Schmitz, Wolfgang Löser, and Bernd Büchner — IFW Dresden, P.O. Box 270116, 01171 Dresden, Germany

Ordinary bulk metallic glasses (BMG) are characterized by high strength, but are usually very brittle. To combine high strength with some ductility, it is necessary to develop new concepts of alloy designing. Here phase separated metallic glasses are chosen, which involve binary terminal systems with both, negative and positive enthalpy of mixing, whereby the structure consists of two different amorphous phases or of nanocrystalline inclusions in an amorphous matrix. Rods and splats of the BMG model system Cu-Zr-Al with small additions of different elements (Gd, Co or Re) with positive enthalpy of mixing to one of the alloying elements are prepared. Their microstructure and glass forming ability (GFA) in dependence of the sample size are investigated and the consequences for mechanical properties are discussed. The GFA is increased by addition of Gd but reduced by addition of Co or Re. The mechanical properties of the Re containing alloys differ strongly from the other alloys investigated by having higher plastic strain at lower stress.

MM 35.2 Wed 11:45 H5

Glass forming ability of iron based amorphous alloys depending on Mo, Cr and Co content — •Uwe Siegel, Uta Kühn, and Jürgen Eckert — IFW Dresden, PF 27 01 16, D-01171 Dresden

The Fe41Co7Cr15Mo14C15B6Y2 multicomponent Fe-based alloy is known to be one of the best glass formers in iron-based systems and shows a critical casting thickness of 16 mm [1]. The elements constituting the alloy have different influences on the glass forming ability. Therefore, the content of Mo, Cr and Co was systematically changed in the master alloy Fe77-x(Co,Cr,Mo)xC15B6Y2 to investigate how these three elements support the glassy microstructure. It was found that a certain content of Mo, Cr, and Co leads to a microstructure of amorphous matrix and alpha-Fe precipitates without any carbides.

[1] Shen, J., Chen, Q. J., Sun, J. F., Fan, H. B. & Wang, G. Exceptionally high glass-forming ability of an FeCoCrMoCBY alloy. Applied Physics Letters 86, (2005).

MM 35.3 Wed 12:00 H5

Thin amorphous tantalum films: Preparation and properties of samples formed by e-beam evaporators — •Kevin Stella[1], Damian Bürstel[1], Steffen Franzka[1], Oliver Posth[2], and Detlef Diesing[1] — [1]Institut für Physikalische Chemie, Universität Duisburg Essen — [2]Institut für Experimentalphysik, Universität Duisburg Essen

Large area ($A = 6\,\mathrm{cm}^2$), thin tantalum films ($5\,\mathrm{nm} < d < 100\,\mathrm{nm}$) are accomplished by evaporation from tantalum rods using small pocket e-beam evaporators. Using a sample to source distance of ≈ 20 cm, homogeneous amorphous films with a small surface roughness ($< 1\,\mathrm{nm}$) can be prepared on glass. Films are characterized by scanning electron microscope images, atomic force microscopy, electrochemical oxidation and resistivity measurements as function of film thickness. The samples show high resistivities of $200 - 2000\,\mu\Omega\cdot\mathrm{cm}$. The temperature coefficient of the resistivity (TCR) is negative as characteristic for highly disordered metals.

MM 35.4 Wed 12:15 H5

Investigation of $(Cu_{60}Co_{40})_{1-x}Zr_x$ Alloys for Glass Forming Ability and Phase Separation — •Björn Schwarz[1], Norbert Mattern[1], and Jürgen Eckert[1,2] — [1]IFW Dresden, Institute for Complex Materials, P.O. Box 270116, Helmholtzstrasse 20, D-01069 Dresden, Germany — [2]TU Dresden, Institute of Materials Science, D-01062 Dresden, Germany

CuZr as well as CoZr are well known metallic glass formers in a wide compositional range. Since the binary CuCo systems exhibits a metastable liquid-liquid miscibility gap, i. e. Cu and Co tend to separate from each other, the ternary Cu-Co-Zr system is a promising candidate to form phase separated glass-glass composites. In this work $(Cu_{60}Co_{40})_{1-x}Zr_x$ metallic glasses down to relatively low Zr contents of $x = 32$ could be prepared by melt spinning technique and the as quenched as well as several heat treated states were investigated by x-ray diffraction, dynamical scanning calorimetry, high-resolution transmission electron microscopy, (in-situ) small angle scattering, x-ray photoelectron spectroscopy and magnetization measurements in order to reveal if phase separation is present in the as quenched amorphous state or if it can be induced by thermal treatment.