loys e.g. Zr-, Ti-based, such glasses show superior mechanical strength. However, due to the general brittleness their wider application as structural materials is strongly restricted. The alternative approach to overcome this defect is to design BMG composites. In this work we present a series of new Fe-Cr-Mo-Ga-(Si,C) composite materials derived from an Fe-Cr-Mo-Ga-C-P-B glassy alloy, with the aim to improve the ductility of this high-strength material. The effect of the composition and the phase formation on the resulting mechanical properties was investigated. It has been found that the formation of a complex microstructure, which essentially consists of soft Ga-rich dendrites embedded in a hard Cr- and Mo-rich matrix, leads to a material with excellent compressive mechanical properties. While the obtained values of true strength are comparable with data reported for Fe-Cr-Mo-Ga-C-P-B BMG, the values of true strain are greatly improved for investigated composites.

MM 43.3 Fri 11:30 H6

Texture and mechanical anisotropy of ultrafine-grained Al alloy AA6016 produced by accumulative roll bonding — •Werner Skrotzki[1], Ingwar Hünsche[1], Juliane Hüttenrauch[1], Heinz-Günter Brokmeier[2], Heinz Werner Höppel[3], and Irena Topic[3] — [1]Institut für Strukturphysik, Technische Universität Dresden — [2]GKSS Forschungszentrum, Geesthacht — [3]Lehrstuhl Allgemeine Werkstoffwissenschaften, Universität Erlangen-Nürnberg

The texture of ultrafine-grained Al alloy AA6016 produced by accumulative roll bonding (ARB) has been measured by neutron diffraction. The starting texture consists of a strong cube component. During ARB this texture breaks down and a texture typical for rolling of face-centred cubic metals with high stacking fault energy develops. The texture after 8 ARB cycles is characterized by the beta-fibre with the Cu component dominating. Moreover, the rotated cube component forms. This component is typical for simple shear which during rolling takes place in the surface layer of the sheets. Based on the Lankford parameter calculated the mechanical anisotropy of the advanced metal sheets will be discussed.

MM 43.4 Fri 11:45 H6

Cu-Ag-alloys: materials with combined optimum properties — •Julia Lyubimova[1], Jens Freudenberger[2], Alexandre Gaganov[3], and Ludwig Schultz[4] — [1]IFW Dresden, Helmholtzstraße 20, 01069 Dresden, Germany — [2]IFW Dresden, Helmholtzstraße 20, 01069 Dresden, Germany — [3]IFW Dresden, Helmholtzstraße 20, 01069 Dresden, Germany — [4]IFW Dresden, Helmholtzstraße 20, 01069 Dresden, Germany

In the present work two alloys, namely Cu - 7wt.% Ag and Cu - 24wt.% Ag, were investigated. The combination of optimum mechanical and electrical properties of these alloys was achieved. The conductor shows a ultimate tensile strength of 1,2 GPa, a strain to failure of 1,6 % and an electrical conductivity of 60 % IACS. The mechanical properties can be improved e.g. by the deformation at low temperatures or by the addition of a third element. The effect of the deformation temperature and also the Zr - addition on the properties of these alloys will be discussed. In addition, the fatigue behaviour of cold worked Cu - Ag - alloys will be shown.

MM 44: Mechanical properties III

Time: Friday 12:30–13:30 Location: H6

MM 44.1 Fri 12:30 H6

Improved plasticity in structurally inhomogeneous bulk metallic glasses — •J. Das[1], S. Pauly[1], K. B. Kim[2], S. Yi[3], W. H. Wang[4], and J. Eckert[1] — [1]IFW Dresden,Institut für Komplexe Materialien, Postfach 27 01 16, D-01171 Dresden, Germany — [2]Department of Advanced Materials Engineering, Sejong University, 98 Gunja-dong, Gwangjin-gu, Seoul 143-747, Korea — [3]Department of Materials Science and Metallurgy, Kyungpook National University, Daegu, 702-701, Korea — [4]Institute of Physics, Chinese Academy of Sciences, Beijing 100080, China

To circumvent the limited ductility of bulk metallic glasses (BMGs), heterogeneous materials with glassy matrix and different type and length-scale of heterogeneities (micrometer-sized second phase particles or fibers, nanocrystals in a glassy matrix, phase separated regions, variations in short-range order by clustering) have been developed in order to control the mechanical properties. As example, recent results obtained for Cu- and Ti-base structurally inhomogeneous bulk metallic glasses will be presented. This type of clustered glasses is able to achieve high strength together with pronounced work hardening and large ductility by controlling the instabilities otherwise responsible for early failure. We emphasize the possibilities to manipulate such spatially inhomogeneous glassy structures based on martensitic alloys in favor of either strength and ductility, or a combination of both and also discuss the acquired ability to synthesize such "M-glasses" in bulk form through inexpensive processing routes.

MM 44.2 Fri 12:45 H6

Deformation kinetics in Zr-based bulk metallic glasses — •Alban Dubach, Florian Dalla Torre, and Jörg Löffler — Laboratory of Metal Physics and Technology, Department of Materials, ETH Zurich, Wolfgang-Pauli-Str. 10, 8093 Zurich, Switzerland

While deformation and flow in crystalline materials can be generally described in terms of the underlying dislocation dynamics, a corresponding formalism for disordered systems is intrinsically less defined. The latter class of materials also includes amorphous metals, which, compared to their crystalline counterparts, exhibit higher yield strength and elastic strain limit, but unfortunately suffer from low ductility at room temperature due to the formation of highly-localized shear bands.

Detailed micromechanical analysis of Zr-based bulk metallic glasses at various temperatures and strain rates facilitate accurate measurements of the inhomogeneous flow kinetics. Our results suggest a micromechanical deformation mechanism based on two processes: shear displacement through the formation and propagation of shear transformation zones, and diffusive structural relaxation processes in the distorted structure. The latter cease below a critical temperature (or above a critical strain rate), resulting in the disappearance of flow instabilities (i.e. serrations) correlated with a change in the strain rate sensitivity. Based on these findings, a constitutive deformation model is presented and similarities with the dynamic strain aging effect known for crystalline metals are elucidated.

MM 44.3 Fri 13:00 H6

Mechanical properties of multicomponent Fe-based glassy alloys — •Uwe Siegel, Uta Kühn, and Jürgen Eckert — Leibniz Institute for Solid State and Materials Research Dresden, PF 27 01 16, D-01171 Dresden

We report on phase formation and mechanical properties of a multicomponent (Fe44,3Cr5Co5Mo12,8Mn11,2C15,8B5,9)98,5Y1,5 glass-forming alloy. The material was prepared as thin ribbons and in form of rods. The samples were investigated by X-ray diffraction, scanning and transmission electron microscopy and DSC measurements. The alloy shows a high glass forming ability (critical casting thickness 12 mm) and high compressive strength (~3000 MPa) but no yielding and strain hardening during room temperature deformation [1]. Therefore the alloy was used as a starting material for investigations concerning the improvement of the mechanical properties. The influence of heat treatments and composition changes on the phase formation and mechanical properties were examined. The strength of (Fe44,3Cr5Co5Mo12,8Mn11,2C15,8B5,9)98,5Y1,5-alloy was found to increase up to ~3500 MPa by the replacement of Cr by Co and up to ~4000 MPa by the replacement of Co by Cr. The addition of elements like Nb or Ag leads to a two phase microstructure consisting of an amorphous matrix and crystalline phases. The microstructure and the mechanical properties of these alloys will be presented.

References: [1] Z. P. Lu, C. T. Liu, J. R. Thompson, W. D. Porter, Phys. Rev. Lett. 92 (2004) 24.

MM 44.4 Fri 13:15 H6

compatible composition profiles and critical sizes of alloyed quantum dots — •huiling duan — Institute of Nanotechnology, Forschungszentrum Karlsruhe, D-76133 Karlsruhe, Germany

The assessment of composition profiles and strains is important to both the identification of the dominant growth mechanisms and the modeling of the confining potential of alloyed quantum dots (QDs). We present first a compatibility equation for the misfit strains in alloyed QDs induced by the mismatch in the lattice constants or the thermal expansion coefficients of their alloying elements and show that it imposes some important restrictions on the alloy composition profiles. We then solve the strain field in embedded alloyed QDs induced by the nonuniform misfit strains. It is found that the induced field is uniform if the misfit strains satisfy the compatibility equation, but not otherwise. Finally, we consider the energy of nucleation of a circular prismatic dislocation loop to relieve the misfit strain and calculate the critical size of a dislocation-free alloyed QD. We show that this size is much larger when the alloy composition meets the restrictions imposed by the strain compatibility equation than when it does not.