Structural Heterogeneities In CuZr-based Bulk Metallic Glasses

S. Pauly[*,#], K. Kosiba, B. Escher

IFW Dresden, Institut für Komplexe Materialien, Helmholtzstraße 20 D-01069 Dresden, Germany

[#]Corresponding author: s.pauly@ifw-dresden.de

Monolithic bulk metallic glasses suffer from shear softening and generally fail in a macroscopically brittle mannerduring uniaxial loading. Only when heterogeneities are introduced can the shear band generation and propagation be impeded and the overall plasticity be increased.However, it is very difficult to deliberately create such structural heterogeneities and, in doing so, to control their size and distribution. This is a vital aspect for optimizing their mechanical properties and for understanding the role of heterogeneities on the deformation mechanisms.

Here, we present results on CuZr-based bulk metallic glasses, which were flash-annealed, i.e. rapidly heated and subsequently quenched to freeze in the microstructure. Depending on the heating rate and the annealing temperature, the glasses can eitherbe relaxed, rejuvenated or partially crystallized. At the early stages of flash-annealing crystals are still absent but the heterogeneity of the glasses can be modified. The analysis of the structure and the mechanical properties reveals a clear dependence on the thermal history. In addition, bulk metallic glasses were subjected to mechanical pre-treatments like elastostatic loading in compression or dynamic compressive loading in the elastic regime. It appears that the competition between relaxation and rejuvenation is largely influenced by the degree of metastability of the as-cast state.Therefore, it is difficult to correlate the compressive plasticity with the respective pre-loading treatment.