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Processing and mechanical characterization of Cu-Zr-Al bulk glassy alloys

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Abstract – Cu-Zr- Al alloys have attracted important attention due to its high glass forming ability and excellent mechanical properties presented by some compositions. In this work $Cu_{56}Zr_{32}Al_{12}$ alloy were processed in amorphous bulk samples and the mechanical properties were measured in compression tests and hardness. Alloy composition has been selected by applying the topological instability λ criterion. The alloy was initially prepared from high pure elements by arc-melting in pure argon atmosphere. The alloys were then remelted for rapid solidification by an injection process to a cooper mould, resulting in cylindrical rod-shaped bulk glassy samples with 2mm in diameter. The results of the mechanical tests were correlated with the structure of the alloys, which was characterized by x-ray diffraction (XRD), scanning electron microscopy (SEM) and differential scanning calorimetry (DSC) we.

New vitreous alloys have been developed in recent years exhibiting low critical cooling rates, making possible to obtain bulk samples suitable to conduct appropriate evaluation of the mechanical properties. Such good glass forming ability (GFA) has been reported for many Cu-Zr-Al alloys, which can present yield stresses up to 2200 MPa, about two times higher when compared with the corresponding values for typical commercial alloys, although still lacking of tension ductility [1]. In this context the design of composite microstructures which might improve ductility, for example, amorphous matrix reinforced with a fine dispersion of nano particles continues to be a relevant topic of research. In the present work a $Cu_{56}Zr_{32}Al_{12}$ alloy, was selected based on the topological instability λ criterion [2] and initially prepared from high pure elements by arc-melting in pure argon atmosphere. Samples for mechanical properties were fabricated by remelting the alloy and injectiong into a cooper mould resulting in rod shaped samples with dimensions of 2mm of diameter by 54mm length). The samples were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) and differential scanning calorimeter (DSC). Measurements of mechanical properties such as compression tests resistance and hardness are reported and correlated with the structural characterization.

References

[1] A. Inoue, Prog.Mat.Sci., 43 (1998) 365.
[2] R. D. Sá Lisboa, Tese de Doutorado PPG-CEM-UFSCar, 2007