Modeling of Temperature-dependent Shear Modulus of Bulk Metallic Glasses

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Abstract

A model of temperature dependence of shear modulus for bulk metallic glasses is proposed without fitting parameters. An inherent relationship between the glass transition temperatures, the Debye temperature and shear modulus of bulk metallic glasses is revealed. The model is presented based on a critical energy density criterion for plastic yielding which is derived from fundamental thermodynamics. The agreement between theoretical results and experimental results is strikingly good. It is found that the temperature-dependent Young's modulus could also be predicted theoretically pretty well by our model.

Keywords: Bulk metallic glasses; Elastic properties; Thermal analysis; Critical energy density