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Metallic glass hardening after thermoplastic forming

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Abstract

Thermoplastic forming is an important manufacturing technique for the shaping of metallic glass (MG) components. However, property changes of MGs after such forming are unclear. This paper systematically studied the effect of thermoplastic forming on the structure and mechanical properties of a Zr-based MG. It was found that the MG after forming is of higher hardness; yet this effect increases with the forming temperature rise. Localized shear deformation as commonly observed around a Vickers indentation mark in MGs was not found around the indentation mark of the thermoplastically formed MG. The study concluded that the primary mechanism of such property change of the MG is due to the free volume annihilation induced by the structural relaxation during the thermoplastic forming.

Keywords

Metallic glasses; Thermoplastic forming; Hardness; Electron microscopy; Viscosity; Free volume

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