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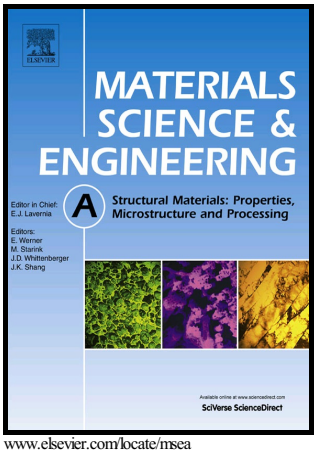

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Rate-dependent Shear Banding and Fracture Behavior in A Ductile Bulk Metallic Glass

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Abstract

The rate-dependent shear banding and fracture behavior of a ductile bulk metallic glass (BMG) under compressive loading are investigated in this paper. The continuous deformation process of the BMG specimens is captured by using the high-speed camera under both quasi-static and dynamic compression. Their characteristic shear banding and fracture behavior are synchronized with corresponding mechanical responses. The rate effect on initiation of shear bands is attributed to an increase in the coalescence rate of free volume. Rate-dependent shear banding behavior, i.e., the transition from multiple shear banding at lower strain rate to single shear banding at higher strain rate, are resulted from an increase in free-volume concentration level with increasing loading rate. The transition of fracture behavior from shear-dominated progressive sliding along slip planes under quasi-static compression to crack-dominated failure under dynamic compression is controlled by the patterns and time-scale of shear banding at various strain rates.