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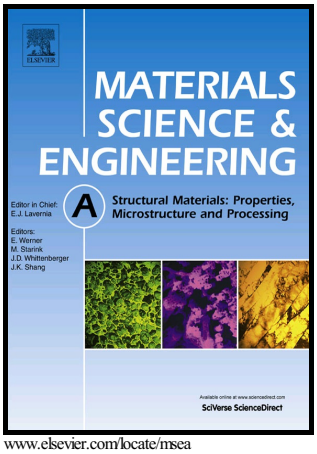

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Investigating shear band interaction in metallic glasses by adjacent nanoindentation

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Abstract

The plastic deformation of metallic glass (MG) at room temperature progresses mainly through shear banding. Although many previous studies have addressed the behaviors of the shear band (SB), there is still some debate regarding the SB processes, particularly its reactivation and interaction. Hence, it is essential to further understand the SB processes in MGs. In this paper, a new method via adjacent nanoindentation was introduced to investigate the SB interaction, which makes it easy to distinguish between the pre-existing and newly generated SBs. Nanoindentation was performed on Zr-based MG under various spatial intervals, and the resultant residual morphologies and serrated flows were comparatively analyzed. With a change in the interval, various SB behaviors, such as straight SBs, SB reactivation, stoppage, intersection, narrowing, and suppression were clearly observed in the interaction region. The evolution of the SBs indicated that the main carrier of the plastic deformation in the interaction region changed between the newly generated SBs and the pre-existing SBs. Corresponding to the strong SB interaction, serrated flows in the load-depth (*P*-*h*) curves were also found to be promoted. These findings are expected to enhance our understanding of SB processes, which is meaningful for controlling the SBs and tuning the surface plasticity of MGs.

Keywords: metallic glass; shear band; interaction; nanoindentation; reactivation; serrated flow

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