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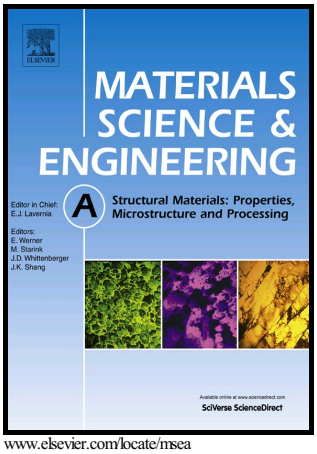

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The mechanism of shear-band blocking in monolithic metallic glasses

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Abstract

The catastrophic failure of shear bands along a dominant shear plane has fatally hampered wide potential applications of metallic glasses. In this study, the blocking of shear bands in monolithic metallic glasses was investigated using an atomic force microscope together with a nanoindenter. At sites of the interaction of two shear bands, if the height of the secondary band is less than that of the pre-existing primary one, the propagation of the secondary band will be blocked, which could lead to the stabilization of glasses. The mechanism of the blocking was explained from the gap of the driving energy between the interactive bands. In addition, from the acceleration of the decreasing rate of the shear offset, it's revealed that more energy can be dissipated at sites of the interaction. These quantitative results provide a mechanistic understanding on the propagation and suppression of shear bands at the nanoscale, as well as a theoretical base to design metallic glasses with promoted plasticity by suppressing the shear band instability.