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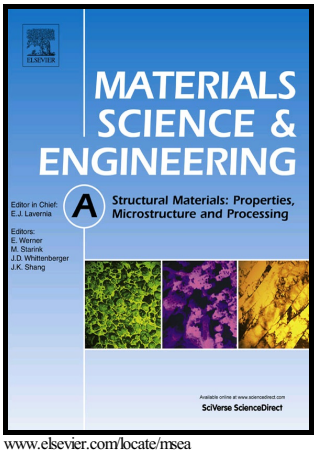

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The introduction of highly dense shear bands and their effect on plastic deformation in Zr and Cu-based bulk metallic glasses

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Abstract

The plastic deformation of the $Zr_{64.13}Cu_{15.75}Ni_{10.12}Al_{10}$ and $Cu_{60}Zr_{30}Ti_{10}$ bulk metallic glasses (BMGs) with arc-shaped edges were performed by compression. Highly dense shear bands with an average spacing of 520 nm are uniformly distributed in a large area in $Zr_{64.13}Cu_{15.75}Ni_{10.12}Al_{10}$ BMG, and the shear band spacing can be reduced to a minimum value of about 110 nm. In the region adjacent to the dense shear bands zone in $Zr_{64.13}Cu_{15.75}Ni_{10.12}Al_{10}$ BMG, the shear band spacing increases linearly. Similarly, highly dense shear bands were also introduced into $Cu_{60}Zr_{30}Ti_{10}$ BMG. When the width of stress concentration zone is of the order of plastic zone size ahead of crack tip, the internal and external stress limitations can lead to the formation of a large number of uniformly-distributed shear bands. In addition, the pre-existing dense shear bands can lead to a non-localized plastic deformation manner for deformed $Zr_{64.13}Cu_{15.75}Ni_{10.12}Al_{10}$ BMG.