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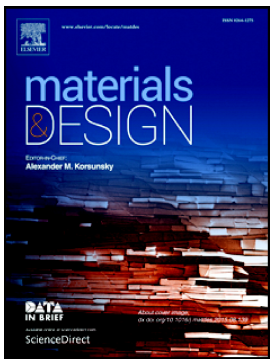

Improving the strength and retaining the ductility of microstructural graded coarse-grained materials with low stacking fault energy

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Improving the strength and retaining the ductility of microstructural graded coarse-grained materials with low stacking fault energy

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Abstract

Gradient structures were introduced via torsional treatment to Cu and Cu-Al alloys with different starting grain sizes and stacking fault energies (SFEs). Systematic investigations showed that the original grain sizes and SFEs of these materials play vital roles in affecting the formation of gradient structures and their corresponding mechanical properties. Large grain size and relatively low SFE are two critical requirements for the formation of the optimum gradient structure. A superior combination of high strength and good ductility can be achieved by torsional treatment in ultra-coarse-grained materials with low SFEs, which is attributed to the hierarchical structures that led to the simultaneous activations of different deformation mechanisms from full dislocation activities to partial dislocation slip and nano-twinning along the radial direction.

Keywords: Gradient structure; Strength; Ductility; Twinning; Stacking fault energy

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