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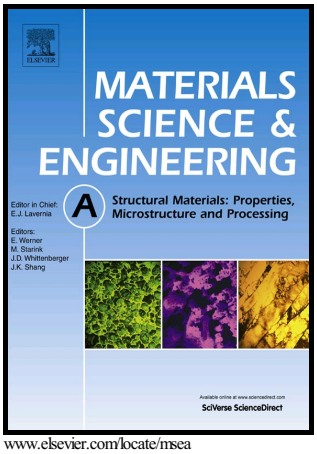

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Improved back stress and synergetic strain hardening in coarse-grain/nanostructure laminates

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Abstract

The effect of back stress on the mechanical behaviors of heterogeneous material is studied in two modeled heterogeneous laminates, i.e. laminated structure with a nanostructured (NS) Cu-Zn alloy layer sandwiched between two coarse-grained (CG) pure Cu layers. The improved tensile ductility of NS layer is revealed and attributed to the constraint from the stable CG layers. It is found that the elastic/plastic interaction between NS and CG layers is capable of significantly improving the back stress, which makes a significant contribution to the synergetic strain hardening in low strain stage. Furthermore, a higher mechanical incompatibility permits stronger and longer mutual interaction between layers, i.e. coupling effect, which contributes to a higher back stress. These results improve our understanding about the role of back stress on mechanical behaviors of heterogeneous laminate materials.

Keywords: laminate; back stress; strain hardening; elastic/plastic interaction; nanostructure

1. Introduction