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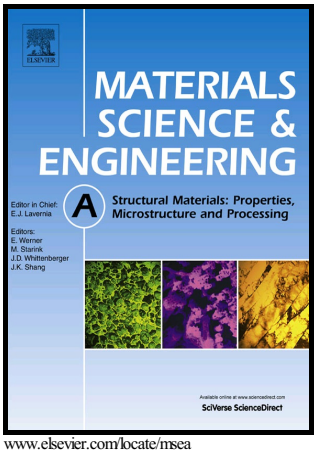

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Competitive effect of stacking fault energy and short-range clustering on the plastic deformation behavior of Cu-Ni alloys

Z.Y. Wang[a], D. Han[a], X.W. Li[a,b*]

[a]Department of Materials Physics and Chemistry, School of Materials Science and Engineering, Northeastern University, Shenyang 110819, PR China

[b]Key Laboratory for Anisotropy and Texture of Materials, Ministry of Education, Northeastern University, Shenyang 110819, PR China

[*]Corresponding author at: Department of Materials Physics and Chemistry, School of Materials Science and Engineering, Northeastern University, Shenyang 110819, PR China. Tel.: +86 24 83678479; fax: +86 24 83683674; xwli@mail.neu.edu.cn (X.W. Li).

ABSTRACT

Uniaxial tensile tests were conducted to investigate the plastic deformation behavior and deformation microstructures of coarse-grained Cu-Ni alloys containing a wide range of Ni contents (5 - 20 at.%), which possess higher stacking fault energies (SFE) than pure Cu. The mechanical testing results show that, with increasing Ni content, i.e., jointly increasing SFE and degree of short range clustering (SRC), the ultimate tensile strength increases, but the ductility keeps almost unchanged; meanwhile, there exists an obvious increasing stage (or "bump") in the strain-hardening rate curves at around 3% engineering strain. Microstructural examinations demonstrate that dislocations are apt to slip on primary slip planes at the initial stage of deformation (e.g., 3% engineering strain) to form planar slip bands, indicating that the existence of SRCs in Cu-Ni alloys is beneficial to the promotion of planar slip, leading to the occurrence of a "bump" phenomenon in the strain-hardening rate curves. With increasing deformation amount to a certain degree, wavy slip becomes the major deformation mode under the joint influence of high SFE and diminution of SRCs, and the final deformation microstructures transform from dislocation cells and cell blocks into extended dislocation walls with increasing Ni content. Both