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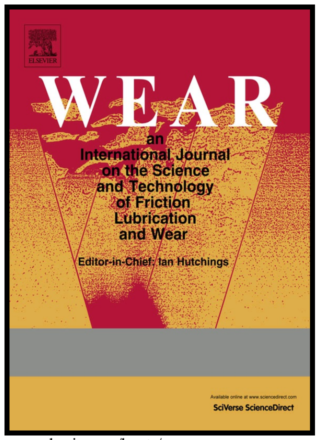

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Microstructure and nanohardness of Ag and Ni under friction in boundary lubrication

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Abstract

Evolution of deformation microstructure and nanohardness of Ag and Ni after friction in the BL regime was studied. All friction tests were conducted under lubricated conditions using a pin-on-disk rig. Pure fcc metals such as Ag and Ni, with different SFE (16 and 125 mJm^{-2}, respectively), were chosen as pin materials. Cross sectional transmission electron microscopy (TEM) lamellae were prepared from the pins using a focused ion beam (FIB). Using TEM, we analysed the regions of the pins that are in steady state after friction; the friction coefficient (μ) and hardness (H_s) remained unchanged with deformation in the BL regime. After the wear tests, the specimens were cross-sectioned in longitudinal and transverse directions (parallel and perpendicular to the direction of friction). Nanoindentations were performed using a Berkovich diamond tip. A gradient of grain sizes during the friction of Ag and Ni in BL regime was revealed by TEM imaging. Deformation twinning followed by limited recovery within the surface of Ag led to the formation of a relatively thick top layer of ultra-fine equiaxial grains. Thermally activated processes for the rearrangement and annihilation of dislocations are accelerated during the friction of Ni due to high SFE and contact temperature. Cross-sectional microstructures observed normal and parallel to the direction of friction are dissimilar. Steady state values of grain size, d_s, and hardness, H_s, after friction in lubricated conditions are explained by the balance

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