

19th World Congress on

Materials Science and Engineering

June 11-13, 2018 | Barcelona, Spain

Deformation microstructure of surface layers of Ag, Cu, Ni and Al under friction in lubricant conditions

Lev Rapoport¹ and Inna Popov²¹Holon Institute of Technology, Israel²Hebrew University of Jerusalem, Israel

Friction and wear are the crucial problems affecting the life time of moving mechanical parts. The main goal of this work is to study: the evolution of the microstructure after friction with lubricant of four fcc metals (Ag, Cu, Ni and Al and the effect of stacking fault energy (γ SFE) on grain size and wear loss. Friction surfaces were carefully examined with a field emission scanning electron microscope. The cross sectional TEM lamellae were prepared from the pins using a focused ion beam (FIB). Cross-sectioning of the specimens was done in the longitudinal and transverse directions (parallel and perpendicular to direction of friction). Deformation twinning followed by a limited recovery within a surface of Ag led to formation of relatively thick top layer of ultra-fine equiaxial grains. Surface regions of Cu and Ni samples consisted of inhomogeneous microstructure with wide range of grain sizes. With a depth lamellar structure was formed parallel to direction of friction for Ag, Cu and Ni. Subdivision of grains into subgrains with high dislocation density is clearly observed within a lamellar structure. Steady state values of grain size, d_s and hardness, H_s after friction in lubricant conditions are explained by a balance between hardening and dynamic recovery in surface layers strongly depending on the γ SFE and temperature.

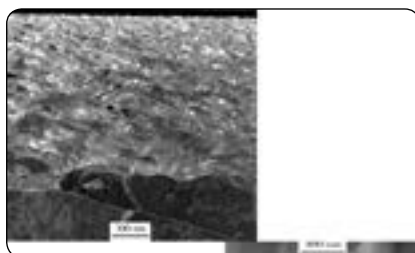


Figure 1: Typical HAADF STEM images of Ag presenting general view of deformation microstructure with a gradient of grain size.

The white arrow shows direction of friction. Black arrows show the pores in top layers

Biography

Lev Rapoport is the Head of the Center for Materials Engineering and the Laboratory of Tribology at the Holon Institute of Technology. Friction and wear research of nanomaterials is known both nationally and internationally. Friction and wear properties of fullerene-like nanoparticles were studied at first in the laboratory of Prof. Rapoport. Prof. Rapoport is a principal investigator in several research grants sponsored by the Israel Ministry of Science, the Bi-national Israel- USA and Germany-Israel Funds. Prof. Rapoport is the author more than 100 publications. He is Vice-President of the Tribology Council in Israel.

rapoport@hit.ac.il