

Examples of third body formation in metallic materials

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Sliding induces severe changes of the material with respect to topography, composition and microstructure by mechanical mixing of the tribocouples with the lubricants and additives ("third body" formation). This third body strongly influences the friction and the wear performance of sliding components yet the generation and the materials properties are barely understood. In our recent work we combined in-situ tribometry with atomistic simulations in order to improve our understanding of nanoscale interfacial processes in metallic tribo couples and coatings. Experiments were performed using a novel experimental platform for the on-line correlation of friction, wear and topography under lubricated sliding and by AFM nanoscratching. The third body was characterized ex-situ by Focused Ion Beam (FIB) analysis, Transmission Electron Microscopy (TEM), X-Ray Photo Electron Spectroscopy (XPS) Nanoindentation and Micropillar compression. Then, in order to elucidate the atomistic level processes which contribute to the observed microstructural evolution in the experiments, classical molecular dynamics were carried out. The combined experimental and simulation data allowed a look at the third body formation of tungsten and tungsten carbide, diamond-like carbon coatings as well as wear particle formation due to folding in copper.