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Friction at Interfaces of Metals and Alloys

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Pure metals such as gold that are frequently used in electrical contacts usually exhibit high adhesion and friction. However, nanocrystalline gold alloyed with minute amounts of Ni or Co can have low friction while still possessing low contact resistance. We used large-scale molecular dynamics simulations with validated EAM potentials to study the atomistic origin of friction reduction in metallic alloys. Three systems will be focused on in this talk: pure Ag, Ag-Cu alloy, and Ag-Au alloy. Our results reveal that different friction coefficients of metals and alloys are due to different sliding mechanisms. Dislocation-mediated plasticity dominates in pure metals or lattice-matched alloys and leads to high friction, while grain-boundary sliding mainly occurs in lattice-mismatched alloys that leads to low friction.