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The link between microstructure and friction in metals

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The tribology community presently relies on phenomenological models to describe the various seemingly disjointed steady-state regimes of metal wear. Pure metals such as gold-frequently used in electrical contacts, exhibit high friction and wear. In contrast, nanocrystalline metals, such as hard gold, often show much lower friction and correspondingly low wear. The engineering community has generally used a phenomenological connection between hardness and friction/wear to explain this macro-scale response and thus to guide designs. We present the results of recent simulations and experiments that demonstrate a general framework for connecting materials properties (i.e., microstructural evolution) to tribological response. We present evidence that the competition between grain refinement (from cold working), grain coarsening (from stress-induced grain growth) and wear (delamination and plowing) can be used to describe transient and steady state tribological behavior of metals, alloys and composites. We will explore the seemingly disjointed steady-state friction regimes of metals and alloys, with a goal of elucidating the structure-property relationships, allowing for the engineering of tribological materials and contacts based on the kinetics of grain boundary motion.

Biography

Michael Chandross has completed his PhD in Physics with Electrical Engineering from MIT and PhD in Physics from the University of Arizona. He had Postdoctoral positions at SPAWAR Systems Center in San Diego, CA and Sandia National Laboratories in Albuquerque and later he joined the Staff of Sandia, where he uses large-scale molecular dynamics simulations to understand the aging and reliability of nanomaterials. He has published more than 50 papers in peer-reviewed journals. He is a Fellow of the American Physical Society and serves on the Editorial Boards of *Lubrication Science and Tribology: Materials Surfaces and Interfaces*.

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