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Linking Microstructural Evolution and Tribology in Metallic Contacts MICHAEL CHANDROSS, Sandia National Laboratories, SHENGFENG CHENG, Virginia Polytechnic Institute and State University, NICOLAS ARGIBAY, Sandia National Laboratories — Tribologists rely on phenomenological models to describe the 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 often show much lower friction and wear. The engineering community has generally used a phenomenological connection between hardness and friction/wear to explain this macroscale response and guide designs. We present 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 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 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. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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