

Establishing an Electronic Basis for Engineering Superior Copper Alloy Behavior

Professor Kathy Dunn

SUNY Polytechnic Institute, Albany, NY

Abstract:

Grain boundaries strongly impact a range of properties and behavior of polycrystalline metals; in nanostructured materials this effect can be even more dramatic because the number of atoms participating in those boundaries constitutes an appreciable fraction of the total atoms in the sample. As a result, observable properties are often dominated by interface, not bulk, material properties. Solute segregating to some or all of these interfaces can change the energy, mobility, structure and cohesion of boundaries through electronic interactions with the surrounding matrix. The nature of these interactions will be examined using a combination of analytical transmission electron microscopy, electron energy loss spectroscopy, and density functional theory. These results will be used to elucidate the correlations between the atomic and electronic structures at grain boundaries and observed electro-mechanical properties of select copper alloys, to enable future materials-by-design.