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The initial oxidation mechanisms of Cu and Cu-Au by in situ UHV-TEM JUDITH YANG, University of Pittsburgh, GUANGWEN ZHOU, Argonne National Laboratory, LIANG WANG, University of Pittsburgh, JEFF EASTMAN, Argonne National Laboratory — A surprising paucity of information concerning the transient oxidation stages, from the formation of the initial oxide to the growth of the thermodynamically stable oxide, still exists. As engineered materials approach the nanometer regime, understanding environmental stability at this scale will become crucial. To bridge this gap, we are visualizing the initial oxidation of copper by *in situ* ultra-high vacuum (UHV) transmission electron microscopy (TEM). The nucleation and growth of Cu_2O due to oxidation of single crystal Cu and Cu-Au films were monitored at various temperatures and pressures. Oxidation potentially involves surface diffusion, nucleation and growth, which is strikingly similar to epitaxial deposition. Heteroepitaxial concepts are surprisingly synergistic with the nucleation and growth of Cu_2O. For pure Cu films, oxygen surface diffusion is the dominant mechanism, whereas for Cu-Au alloys, initially surface diffusion is the dominant mechanism but then an entirely different mechanism of Cu diffusion through an Au-rich layer becomes the rate-controlling step for Cu2O growth.

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