

Abstract Submitted
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Stress development and relaxation during early stages of oxidation of metals and alloys¹ GUANGWEN ZHOU, CHANGHONG KE, State University of New York, Binghamton, JUDITH YANG, University of Pittsburgh, JEFFREY EASTMAN, JOHN PEARSON, Argonne National Laboratory — It has been long recognized that oxidation of metals results in the generation of stresses and these stresses play an important role in shaping the microstructure of oxide films. However, the mechanism governing the stress development and relaxation during early stages of oxidation of metals and alloys is still to a significant degree unclear. Using a combination of in-situ ultra-high vacuum (UHV) transmission electron microscopy (TEM) and finite element method, we show how oxidation-induced stresses can be used to tailor the initial oxide formation during early-stage oxidation of Cu(100) and Cu-Au(100). From analysis of the observed morphological evolution of Cu₂O nanoislands, we establish a close relationship between the stresses generated from the oxide growth and the thermodynamic selection of nanoscale morphology of the oxide film. We expect that our results have implications for controlled production of novel oxide nano structures through controlling the oxidation-induced stresses via oxidation temperature or alloying.

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