The Summer Undergraduate Research Fellowship (SURF) Symposium
2 August 2018
Purdue University, West Lafayette, Indiana, USA

Grain Boundary Motion Analysis

Jeremy S. Marquardt
Department of Nuclear Engineering, University of Purdue
Xiaorong Cai, and Marisol Koslowski
Department of Mechanical Engineering, University of Purdue

ABSTRACT

Grain growth is a mechanism to relax residual stresses in thin films. These grains grow out of the thin film surface and are known as whiskers. These whiskers can cause short circuits, so developing scalable and cost effective solutions would increase the reliability and utility of tin electronics. A popular of method of examining tin whiskering is microscopic simulation, as it provides an accurate and cost effective way to predict the consequences of proposed models. Specifically examining the evolution of grain boundaries, this paper aims to present the results of grain boundary motion simulations through a generalized program that streamlines and optimizes the analysis process. Various simulations examining the effects of grain boundary energy and mobility were run through Idaho National Laboratory's Multiphysics Object Oriented Simulation Environment (MOOSE), with processing, analysis, and presentation provided by a Jupyter Notebook program that is available online. The Notebook program was found to graph effectively and flexibly, creating results which provide quantitative data and clear visualizations of the MOOSE simulations, providing examples of how the mobility and energy values of grain boundaries of Tin significantly affect grain migration. The Jupyter notebook will be deployed as a tool in nanohub.org.

KEYWORDS

finite element, simulation, grain motion, data visualization