

**MATERIALS SCIENCE AND ENGINEERING  
SEMINAR**

**“The influence of the effective physical properties of tin electrodeposited films on the growth of tin whiskers”**

by

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**ABSTRACT**

The purpose of the present study was to characterize and calculate the effective film properties of tin electrodeposited films to determine factors influencing the growth of tin (Sn) whiskers. The growth of Sn whiskers represents an increased risk to the reliability of electronic devices, and is a particular concern in the high reliability environments demanded in aerospace and defense applications. Efforts to prevent whisker growth have proven difficult, in part, due to the lack of understanding concerning the fundamental mechanisms responsible for whisker growth. In the present study, Sn, Sn-Cu, and Sn-Cu-Pb films were electrodeposited from commercial electrolytes with different deposition parameters. The morphology of Sn hillocks and whiskers were characterized leading to a growth model considering the role of grain boundary mobility. Crystallographic texture measurements revealed non-random textures, dependent on electrolyte type, electrolyte additives, deposition current density, and film thickness. The crystallographic texture was also found to evolve with time, indicating recrystallization and grain growth. The corresponding textures were used to calculate the effective physical properties of the films, showing significant differences in the linear modulus of elasticity, biaxial modulus of elasticity, and coefficient of thermal expansion. The influence of these effective properties on the strain energy density of the film was analyzed with respect to the evolution of crystallographic texture and film stress. The results show that the reduction of strain energy and surface energy are not the only influencing factors dictating the evolution of the crystallographic texture. Recommendations are made for future studies to apply the analysis tools developed in this study for future whisker research, as well as for industrial applications.

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