

Influence of Substrate Surface Roughness on Sn Whisker Growth

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ABSTRACT

Implementation of Pb-free electronics has resulted in use of pure Sn finishes which are known to pose a reliability issue due to the spontaneous growth of Sn whiskers. In this study, atomic force microscopy (AFM) has been used to investigate the effect of surface roughness on Sn whisker growth. The varying (brass) substrate roughness conditions have been created by an unpolished surface, an electrochemically-polished surface, and a mechanically-polished surface. Subsequent Sn deposition using magnetron sputtering techniques produced a thin ($\sim 6000 \text{ \AA}$) Sn film on the brass. Results show that the smoother brass substrates produced significantly more Sn whiskers than rougher surfaces. Both the quantity of whiskers is greater and the average whisker length is longer as the brass smoothness increases. This is contrary to conventional wisdom which presumes that rougher surfaces offer more stress and enhanced whisker growth.