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Reliability Testing of Ni-Modified SnCu and SAC305 - Vibration

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Abstract

Interest in alternate lead free solder alloys has initiated a life prediction study of SN100C. This paper outlines the results of the vibration portion of the testing and demonstrates that it's roughly comparable to that of SnPb. A fatigue component of 6.4 is used, the same as that used for SnPb. The resulting component dependent lifetime predictions are conservative, but usable for predicting the time to failure of SN100C solder joints.

Key words: SN100C, High cycle fatigue, Vibration, Steinberg

Introduction

Since the institution of Restriction Of Hazardous Substances (ROHS) Directive in the European Union on July 1, 2006, and mounting legislation in Asia and the rest of the world, concerns related to lead-free (Pb-free) reliability of solders, particularly on large surface mount devices, have been growing. While much of the consumer industry has embraced SAC305 the concern over its drop/shock performance in mobile applications, its effect on wave soldering equipment, and the cost of silver has led to research in other Pb-free tin-copper (Sn-Cu) metallurgies with little or no silver, such as SAC105, SAC0307 (0.3% silver) SN100C and other tin-silver-copper alloys (SACX).

The Sn-Cu without silver was quickly rejected as a viable alternative to Sn-Pb solder due to an undesirable grain structure. Joints formed of Sn-Cu alone demonstrated a cracked and dull surface finish with visible dendrites, and had poor strength properties. However, with the addition of silver or nickel, the appearance and behavior of Sn-Cu can be improved.

Nihon Superior contracted DfR Solutions to test their SN100C (Sn-0.7Ni-0.05Cu+Ge) alloy in order to generate an acceleration factor (AF) and other models for failure prediction and accelerated life testing. Thermal cycling, mechanical shock after aging, and vibration tests were all performed. SnPb and SAC305 were tested in parallel under the most severe conditions of each experiment type. For detailed procedures, please reference *Accelerated Life Testing of SN100C for Surface Mount Devices*ⁱ.

ⁱ Arnold, et al. "Accelerated Life Testing of SN100C for Surface Mount Devices," IPC/JEDEC Global Conference on Lead Free Reliability and Reliability Testing for ROHS Lead Free Electronics, Boston, MA, 2007.