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Assessing the Reliability of Microelectronics Interconnects

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Assessing the Reliability of Microelectronics Interconnects

The industry relies heavily on so-called ‘engineering tests’ in which representative test vehicles are compared to each other or general specs without specific reference to life in service. This presentation will offer an overview and discussion of why such tests may often be misleading and the associated mechanistic understanding will be outlined.

Assessing the Reliability of Microelectronics Interconnects

The long term reliability of a high end microelectronics product is commonly limited by the wear-out and failure of one of its vast number of solder joints. Massive ongoing efforts by the industry address this by a series of accelerated tests. The overwhelming majority of tests are not aimed at a quantitative prediction of the life in service. Rather ongoing 'engineering tests' focus, at least implicitly, on comparisons between alternative materials, designs or processes or more often simply on meeting certain specifications. Even such tests are, however, often meaningless and sometimes seriously misleading if they do not reveal something about relative performance in service.

This presentation will briefly outline our current understanding of damage evolution and failure for common surface mount and area array components attached by SnAgCu solder joints. Depending on the service conditions such a joint may fail through the bulk of the solder, through the intermetallic bond to one of the contact pads, or by solder pad cratering. Reliability engineers are often concerned that accelerated testing may lead to different failure modes than those dominating under realistic service conditions. Less attention is usually paid to the risk of comparisons and generalizations of results being affected by very different acceleration factors for different components and designs.

A variety of examples will be presented of cases where results seem counterintuitive and/or accelerated testing favored the wrong design, or otherwise proved misleading. These will all be explained based on the underlying materials science and practical recommendations. The latter will include guidelines for so-called ESS protocols.