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Critical level of water film formation under transient condensing condition leading to PCBA failures

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Electronics industry increases packing density on printed circuit board assembly surfaces together with device miniaturization. Exposure to harsh climatic conditions introduces a number of serious humidity-related reliability issues, and the water film forming on the PCBA surface is found to be the critical factor determining the reliability of the electronics. The thickness of the water layer is dependent of the PCBA surface and its architecture, the presence of hygroscopic residues, the humidity level in the environments, and the temperature fluctuations.

The water film build-up on the PCBA surface is the key factor determining the electronics reliability, such as leak current and electrochemical migration (ECM); therefore, it is important to correlate the water layer thickness and the electrochemical response to understand the critical level of water film build up.

This study aims to provide quantifiable physical values for assessing and predicting the reliability of electronics, through accurate condensation experimental set-up. Water layer thickness has been determined under dynamic and equilibrium conditions, with and without the presence of weak organic acid on the PCBA surface, and are correlated to impedance and leak current data measured on surface insulated resistance (SIR) pattern. The leak current data can be correlated to failure occurrence.

Keywords: Condensation, conductivity, contamination, humidity, impedance, leak current, reliability, thickness, water film