Printed Circuit Board Surface Finish and Effects of Chloride Contamination, Electric Field, and Humidity on Corrosion Reliability

Corrosion reliability is a serious issue today for electronic devices, components, and printed circuit boards (PCBs) due to factors such as miniaturization, globalized manufacturing practices which can lead to process-related residues, and global usage effects such as bias voltage and unpredictable user environments. The investigation reported in this paper focuses on understanding the synergistic effect of such parameters, namely contamination, humidity, PCB surface finish, pitch distance, and potential bias on leakage current under different humidity levels, and electrochemical migration probability under condensing conditions. Leakage currents were measured on interdigitated comb test patterns with three different types of surface finish typically used in the electronics industry, namely gold, copper, and tin. Susceptibility to electrochemical migration was studied under droplet conditions. The level of base leakage current (BLC) was similar for the different surface finishes and NaCl contamination levels up to relative humidity (RH) of 65%. A significant increase in leakage current was found for comb patterns contaminated with NaCl above 70% to 75% RH, close to the deliquescent RH of NaCl. Droplet tests on Cu comb patterns with varying pitch size showed that the initial BLC before dendrite formation increased with increasing NaCl contamination level, whereas electrochemical migration and the frequency of dendrite formation increased with bias voltage. The effect of different surface finishes on leakage current under humid conditions was not very prominent.

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