
Parametric Study of Regional Climates on Electronics: Understanding Local Climate Effects on Corrosion Failure Mechanisms.

Master Thesis

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Abstract

The reliability of electronic products under different climatic conditions is one of important factors for electronic manufacturers. In the practical applications of electronic components, the failures may be caused by the design and materials issues, but these failures can also be caused by the environmental conditions during the service life of the electrical products, such as temperature, humidity and the presence of hygroscopic contaminations on the surface of electronic products. When these factors are existing along or in the combination in the actual practical applications, it is very likely to form intermittent failures in electronic products.

In the climatic experiment, a climatic chamber was used to simulate the climate varying of different regions from arid to humid climate and high temperature to low. Meanwhile, the internal humidity and temperature of chamber and enclosures was recorded with the relation of the leakage current on surface insulation resistance – printed circuit board (SIR-PCB). The main variables in the experiment include different pitch sizes of comb patterns, different pre-contaminated weak organic acids, with and without the presence of thermal mass, with and without the presence of enclosures and the hole sizes of enclosures.

The results of this experiment provide a deep understanding of the average failure rate of electronic products based on the climate conditions and packaging design of electronic products. The fluctuations of temperature and humidity during the 24h climatic cycle can cause the formation of condensation water on the electronics, especially if the dew point is very close to the air temperature. In addition, the presence of hygroscopic contaminations and the thermal delay of the thermal mass can enhance the possibility of condensation water to form on the surface of PCB, resulting in the corrosion reliability problems and the permanent failures of electronic products.

Keywords: Climate, Contaminations, Enclosures, Humidity, Leakage current, Impedance tests, Thermal mass, Water layer formation, Printed circuit board.