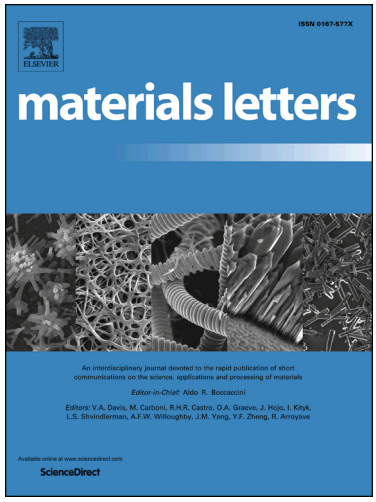

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Role of mold in electrochemical migration of copper-clad laminate and electroless nickel/immersion gold printed circuit boards

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Abstract: The role of the mold in electrochemical migration (ECM) of printed circuit board (PCB) under DC bias was investigated using environment scanning electron microscope, 3D stereology microscopy, and scanning Kelvin probe. The mold under electrical bias can grow well and complete with the processes of growth, metabolism and proliferation. The mold can also promote metal ionization and localized corrosion and provide the ion source for ECM process. The cooperation of mold and DC bias promote ECM process on PCB and aggravate short circuit failure behavior. The proposed ECM mechanisms explain the ECM process of PCB under mold and DC bias environment.

Keywords: Corrosion; Electronic materials; Multilayer structure; Surface

1 Introduction

Currently, the further miniaturization and highly integrated circuits are the main directions of electronic material development given the requirement of portable and multi-functional products. However, unfortunately, a slight extent of corrosion may result in this electronic device failure or paralysis [1]. Recently, the failure behavior of PCB under corrosive gas environment has also been reported [2] and demonstrates that the corrosion on ENIG occurs primarily through the porosity in the coating. It is noteworthy that ECM induced by corrosion under DC bias is a more common and serious failure form for PCBs in the service condition.

Most studies concerning ECM at present tackle the effects of ionic contaminants [3, 4] or residues [5] through either temperature humidity bias test or outdoor exposure tests and ECM sensitivity by water drop tests [6]. However, to the best of our knowledge, few studies concerning the effects of mold, which is a widespread pollutant in the atmosphere environment, on ECM were conducted. Consequently, the ECM mechanism induced by mold growth is still unclear. On the other hand, the occurrence of mold growth and corrosion failure on PCB and connectors has also been observed in the communication equipment of International Space Station (ISS) [7, 8]. Moreover, our group previously also found the presence of mold