

FRETTING CORROSION BEHAVIOUR OF ELECTROLESS Ni-B COATED CONTACTS

Fretting, an accelerated surface damage that occurs at the interface of contacting materials subjected to small oscillatory movement is a common problem in many engineering applications. The deleterious effect of fretting in electrical connections assumes significance as it influences the reliability and system performance. Gold and other precious metal plated contacts are the preferred choice where high reliability is warranted. However, non-noble metal plated contacts have also gained popularity due to the market pressure to reduce the cost factors. Based on the performance, cost criteria and the compelling need to adopt lead-free processes, tin plating is considered as the best candidate and has been recommended as the finish of choice for connectors. However, the susceptibility of tin plated contacts for fretting corrosion is a major limitation for its use in electrical connectors. EL Ni-B coating possesses high hardness, superior wear resistance, moderate corrosion resistance, good solderability, and low thermal expansion coefficient. It is more wear resistant than tool steel and hard chromium coatings. The columnar structure of the EL Ni-B coating makes it naturally lubricious and it offers improved performance under conditions of adhesive wear. EL Ni-B coating is considered as a useful alternative for gold and silver in microelectronic devices. EL Ni-B coating possess good solderability compared to EL Ni-P coating because its oxide layer is thin and can easily be penetrated by the solder. EL Ni-B coating has received considerable importance in the copper interconnect technology as a capping layer due to its ability to prevent the diffusion of copper. We have evaluated the performance of EL Ni-B coated brass contact under fretting conditions to assess its suitability for electrical connector contact applications. The change in contact resistance as a function of fretting cycles reveals the ability of EL Ni-B coated brass contacts to offer a better stability under fretting conditions. The superior wear resistance of the EL Ni-B coated contacts enables them to offer a better performance than tin coated contacts under similar conditions. EL Ni-B coated contacts fail to exhibit a better performance at highly oxidizing conditions such as low frequency and high temperature. Though the initial oxide film formed on EL Ni-B coated contacts is self-limiting, their quick removal by fretting motion, rapid

oxidation of the fresh metallic particles and trapping of the oxidation products in the remaining coating causes the contact resistance to increase to unacceptable levels at highly oxidizing conditions. The study concludes that EL Ni-B coating is not a suitable choice for connector contacts that could experience fretting under highly oxidizing conditions. The important findings of this work are addressed in the following paper:

1. T.S.N. Sankara Narayanan, Young Woo Park and Kang Yong Lee, Evaluation of electroless Ni-B coating under fretting conditions for electrical connector contact applications, [Surface Review Letters, 15\(4\) \(2008\) 443-452](#).