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A Method for Power Rating Contacts using Voltage Drop

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Abstract

A method of using voltage drop (and change in voltage drop after aging) is proposed in rating the performance of power contacts. It was shown in previous papers that change in voltage drop exhibits a stability threshold for various materials. This feature is employed in a method that monitors voltage drop through life testing. Moreover, a statistical model for the end-of-life change in voltage drop is provided to demonstrate the approach. The steps necessary to achieve this are laid out in terms of sample type, accelerated tests, voltage drop measurements, failure criteria and application of statistical analysis to achieve an empirically based rating process.

The present paper expands on previous work by extending the database and analysis techniques. In this case, samples are exposed to high current cycling at current levels that produce high temperature rises. This approach provides degradation due to thermal aging. Processes such as stress relaxation, diffusion and electro-migration, and oxidation are accelerated. In this work, several high current levels are used to accelerate the progression of degradation. It is shown that a statistical method of rating power contacts in terms of current level and expected field life can be accomplished.

In addition, the results are analyzed using basic contact theory in conjunction with statistical modeling. Moreover, current density and contact voltage are discussed as basic physical parameters that provide links to aging and failure criteria. The aim is to develop a method using voltage drop for various contact materials to quantify power rating of contacts for use in the field.

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