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Material effects on arc characteristics and electrical contact damage

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Electrical contacts used in automotive relays are degraded by electrical arcing occurring during turn on and off the switches. Prominent pips and craters may form on the surfaces of the electrical contacts. The formation of pips and craters is due to the material transfer between anode and cathode contact and closely related to the arc characteristics occurring between two contacts. This surface erosion along with the formation of oxide and carbide compounds on the surface can cause switch failures. In this study, we have investigated the effects of contact materials on the contact resistance and surface erosion. We found that not only contact materials but also contact arm (plate spring) materials have significant effects on the direction of material transfer between anode and cathode contact, hence the formation of pips and craters. Repetitive switching has been performed by applying a constant current of 9 A and 20 A at 12 VDC with DC electronic load. Voltage drops were measured during the tests and the contact surface morphology and composition of the contacts were analyzed after 30,000 switching by using digital optical microscopy and Energy-dispersive Spectroscopy (EDS) in Scanning Electron Microscopy (SEM), respectively. AgCu alloy and Ag metal oxide contacts showed the formation of craters on cathode and pips on anode contact when BeCu alloy contact arm is used. Interestingly, AgCu alloy contact attached on NiCu alloy contact arm showed the inverse material direction, i.e., prominent erosion occurred on anode contact and material deposition observed on cathode contact. This phenomenon will be discussed based on the measurement of the arc characteristics during contact closing and opening. The change of contact resistance and the formation of surface compounds will be compared among different contact materials.

Biography

Seulki Hwang is presently associated with Department of Materials Science and Engineering, Myongji University, Republic of Korea. She has published numerous research papers and articles in reputed journals and has various other achievements in the related studies. She has extended her valuable service towards the scientific community with her extensive research work.

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