EROSION AND CONTACT RESISTANCE PERFORMANCE OF MATERIALS FOR SLIDING CONTACTS UNDER ARCING

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Abstract : In our previous work we have investigated copper sliding switching contacts for automotive power applications. In order to improve their reliability, we have studied in this present paper, alternative materials to copper such as silver based materials (Ag, $AgSnO_2$, AgC and AgCNi). Their performance was evaluated by measuring mass variations and contact resistance stability during sliding. The contacts are operated in a test machine during 50,000 sliding operations, under inductive loads which produce long arcs, or under lamp loads which produce a short arc.

In most cases, we have seen a significant wear of the anode compared to the cathode. We believe that the wear process for the sliding contact is the abrasion of the track by a rough contact surface. This roughness is produced and renewed by material transfer because of arcing. Regarding this wear, we show the medium performance of Ag and Cu contacts, while the worst performance is obtained with AgC and AgCNi, which make these latter materials unsuitable. Regarding contact resistance, we have measured low values < 1mΩ for AgC, AgCNi and Ag. With $AgSnO_2$ and Cu contacts, the resistance can reach high values, especially with an inductive load, which make these latter materials unsuitable.

Concerning the effect of operating parameters, we show that polarity may emphasize the already poor performance of a high wear anode by disturbing the sliding motion. In addition, contact force and shape size are found to act in opposite ways on material performance. Low force and large shape (cylinder) reduce wear and enhance resistance whereas high force and small shape increases wear and lowers contact resistance.

Keywords : Sliding contact, Materials, Erosion, Contact resistance, Automotive