

Dynamics of Electrical Contact Floating in Vacuum

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Abstract- Phenomenon of contact floating due to metallic vapour pressure produced by a vacuum micro-arc just after first contact making is investigated experimentally and then it is described by a mathematical model. All consecutive stages of a make-break operation, including contact penetration, restitution, bridging and micro arcing are studied in dynamics. Two mechanisms of bridging and micro arcing are considered. The first one is concerned with melting and evaporation of a microasperity on the contact surface, while the second one is conditioned by stretching and explosion of a liquid drop during contact opening. The mathematical model contains the differential equations describing arc energy dynamics, heating and evaporation of contact material, motion of the contact piece caused by contact spring, elastic force at restitution and vapour pressure. A standard vacuum bottle with laser sensors for measurement of contact gap dynamics is used to capture experimental data of floating parameters. Special multiscale equipment is used to obtain current and voltage oscillograms with required resolution. Experimental and calculated results show that metallic vapour pressure at micro arcing is capable to cause contacts to float even in a vacuum condition for very short duration. The model also enables calculation of the area of melted zone on the contact surface during floating and parameters of possible micro welding.