

Measuring emissivity of contact material using a thermography camera

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ABSTRACT

Some vacuum interrupters (VI) are equipped with transversal magnetic field (TMF) contacts. According to the current path, a transversal directed Lorentz-force causes the contracted arc to move in a circle in order to reduce the local overheating of the surface. The erosion degree depends on the arc root temperature, which is often above the melting point of the contact material.

The temperature of the contact surface can be measured using a high-speed thermography camera. However, the emissivity of the investigated contact material must be identified before the measurements can be taken. Values of spectral emissivity for melting copper at several spectral wavelengths with a view angle of 90° are given in the literature as being between 0.1 ($\epsilon \approx 600 \text{ nm} - 1000 \text{ nm}$) and 0.4 ($\epsilon \approx 400 \text{ nm}$). To determine the emissivity for the wavelength range of the thermography camera, a vacuum recipient, an induction heating coil and an observation window were set up in our laboratory for the experiment. Experiences collected during the experimental investigations are summarized in this paper. One of the main challenges we faced was the production of a stable and observable melt to be investigated based on different viewing angles. The procedure for measuring the emissivity is illustrated by a real measurement with copper for practical insight and ideas. We identified the total spectral emissivity of melting copper for $\lambda = 1.5 - 1.7 \text{ }\mu\text{m}$. Based on the emissivity of the contact materials, the contact temperature after the arc will be measured in future experiments.