Magnetic method To characterize the Current Densities in a Breaker Arc

Nadia Machkour

National Institute of Standards and Technology, 100 Bureau Drive, Stop 8223, Gaithersburg, MD 20899, USA
nadia@nist.gov

The purpose of this research was to use magnetic induction measurements from a low voltage electric arc, to reconstitute the arc's current density. The measurements were made using Hall effect sensors, which were placed close to, but outside the breaking device. The arc was modelled as a rectangular current sheet, composed of a mix of threadlike current segments and with a current density varying across the propagation direction. We found the magnetic induction of the arc is a convolution product of the current density, and a function depending on the breaker geometry and arc model. Using deconvolution methods, the current density in the electric arc was determined.

The first experimental verification of the model was obtained using reconstruction of the current density in a conductor bridging the arc gap. Next, the method was used to study the arc behavior into the breaker device. Notably, position, arc size, and electric conductivity could all be determined, and then used to estimate an arc temperature. From the calculated current density and arc size, we could also characterize the arc mode, diffuse or concentrated, and study the condition of its mode changing.