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Pulsed laser measurement of temperature and conductivity of a decaying arc channel PATRICK STOLLER, EMMANOUIL PANOUSIS, JAN CARSTENSEN, VALERIA TEPPATI, ABB Switzerland Ltd. — When a high voltage circuit breaker interrupts alternating current, the arc established between its contacts is axially blown by a transonic gas flow until it is extinguished at a current-zero crossing. Improvement of circuit breaker design to achieve higher short circuit current ratings or more compact equipment relies on an understanding of the processes involved in cooling and interruption of the arc. At present, current, voltage, and pressure measurements together with CFD simulations give only limited insight into how the arc is cooled—mainly via convection and radiation—and finally is interrupted via turbulent mixing. Measurement of the density, temperature, and conductivity of the arc embedded in a gas-flow would permit validation of the CFD simulations and allow direct quantitative determination of important parameters such as the arc and boundary layer width and temperature. We have developed a Speckle imaging technique that permits determination of these parameters via measurement of the refractive index. A pulsed, nanosecond laser is used to interrogate the arc and surrounding flow. The short pulse length permits visualization of turbulent flow features and prevents smearing of time varying features of the flow and the arc that may occur if a continuous wave laser is used. We present and compare to CFD simulations measurements of the temperature, density, and conductivity of axially blown arcs. Based on these results we examine the dependence of the arc width on blowing conditions.

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