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Simulations of cathode crater formation by arc discharges[1]
DMITRY LEVKO, ROBERT ARSLANBEKOV, VLADIMIR KOLOBOV, CFD Research Corporation, VALERIAN NEMCHINSKY, Keiser University — Understanding electrode erosion by arc discharges is important for many arc-based technologies [1]. In spite of numerous applications, there is still no widely accepted model of arc interaction with electrodes in either vacuum or high-pressure arcs. In this paper, we will present a model of the cathode crater formation for high-pressure arcs. In this model, the dynamics of melted cathode material is described using two-fluid model. The gas-liquid interface is tracked with adaptive Cartesian mesh using the volume-of-fluid (VoF) approach. The heat transport equation is solved in gas, liquid and solid phases to describe melting, vaporization and solidification of the cathode material. The melted liquid pool moves due to metal vapor pressure. We analyze how the arc current, cathode spot radius, cathode sheath voltage etc. influence the dynamics of crater formation and droplet emission from the crater after the plasma switching off. Our simulations confirm the point of view [2] that the arcs operate at the boundary between the spreading and splashing regimes of the crater dynamics. [1] A. Anders, Cathodic Arcs: From Fractal Spots to Energetic Condensation, Springer (2008). [2] M. A. Gashkov and N. M. Zubarev, IOP Conf. Series: Journal of Physics: Conf. Series 946, 012131 (2018).

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Dmitry Levko
CFD Research Corporation

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