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Three-Dimensional Numerical Modeling of Free-Burning Arcs Using a CFD-MHD Coupled Method JONG-CHUL LEE, WON-HO LEE, Gangneung-Wonju National University, YOUN-JEA KIM, Sungkyunkwan University — Because a scientific understanding of the thermal behavior of arcs and their electrodes in free-burning arc systems is very important for improving industrial applications, numerous theoretical and experimental papers have been published in the last decade. However, the flow patterns inside the free-burning arc system must be of the 3-D feature, and 2-D modeling cannot help in predicting the 3-D flow and heat transfer within the system. This paper is concerned with developing a capability to model free-burning high-intensity argon arcs (self-consistent model) and enhancing the accuracy of numerical results according to three-dimensional calculations. It was found that the computed temperatures along the axis between the cathode tip and the anode surface show good agreement with two different measured data. Although the LTE model can reasonably predict the overall arc voltage for free-burning arcs, it fails to account accurately what happens at the near electrode region. An accurate solution near electrodes has to be based on non-LTE model to ensure current continuation in the low temperature region. Calculation of the energy flux towards the anode also requires the mechanisms operating in the non-LTE situation be taken into account in the model.

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