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DEVELOPMENT OF 3D ELECTROMAGNETIC THERMAL FLUID SIMULATION FOR ELUCIDATION OF MOVEMENT FACTORS IN VACUUM ARC

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It has been suggested that the movement factors of cathode spot are the electromagnetic force and force caused by pressure gradient. However, the quantitative force values causing movement has not been disclosed. In this paper, the movement factors of vacuum arc clarified that either electromagnetic force or force caused by pressure gradient is 9.98×10^4 ~ 6.87×10^5 N/m^3 . The parameters of calculation were the external magnetic flux density and amount of metal vapor. In this simulation, the ion current was calculated from the behavior of ions in order to analyze the retrograde motion in the vacuum arc. The ion current is larger than the electron current in the cathode spot because the number density of ions is large in cathode spot. In addition, the direction of ion current is the cathode to anode caused by the pressure gradient. For these reasons, the phenomenon of retrograde motion increases with increasing the electromagnetic force and amount of metal vapor. Moreover, the two cathode spots were analyzed. The parameter is the distance between two cathode spots in order to elucidate that the electromagnetic force or force of pressure gradient dominates. As a result, one cathode spot was moved by the force of pressure gradient with the other cathode spot, but one cathode spot was not moved by the electromagnetic force with the other cathode spot. Thus, the force of pressure gradient is dominant. Therefore, the 3D electromagnetic thermal fluid simulation was developed in order to elucidate the movement factors of cathode spot in the vacuum arc.

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