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Interactions between thermodynamic and chemical non-equilibrium states in an arc plasma HE-PING LI, HENG GUO, JIAN CHEN, Tsinghua University, DEPARTMENT OF ENGINEERING PHYSICS TEAM — Since the power input rate is usually higher than the energy exchange rate between the sub-systems of electrons and heavy particles in low temperature plasmas, the electron temperature typically exceeds that of heavy particles, which makes the plasmas deviate from local thermodynamic or even local chemical equilibrium state. It is indispensable to investigate the complicated fundamental processes in a non-equilibrium plasma system with the aid of numerical simulations so as to optimize the discharge operating parameters. In this study, a full non-equilibrium physical-mathematical model is employed to simulate the non-equilibrium transportation processes in a free-burning argon arc, which is regarded as a model system for arc plasmas. Based on the two-dimensional non-equilibrium modeling, the complex interactions between the electron and heavy-species sub-systems are investigated. The modeling results show that, on one hand, the collisions between electrons and heavy particles influence directly the energy and mass transfer processes between these two sub-systems; while on the other hand, there exists an interaction between the non-uniform spatial temperature distributions of electrons and heavy particles, which has never been reported in previous publications.

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