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A 2-Temperature Model for High Pressure High Temperature Thermal Plasmas NING ZHOU, ESI CFD — The high pressure thermal plasmas due to its high temperature and high ionization degree, are generally modeled using equilibrium assumptions. As the results, many variables can be expressed as the functions of thermodynamic states. And in particular, the electric conductivity is measured and curve-fitted as the function of temperature, pressure for the given gas mixture. This model is attractive for its simplicity, but it neglects some important aspects of physics and is subject to the accuracy of the measured coefficients. A fluid model for high pressure high temperature thermal plasmas such as arc discharge, is therefore proposed. In this model, the thermal non-equilibrium effect is considered by solving the temperatures for electron and gas, respectively. The plasma chemical kinetics is modeled by the finite-rate reactions and the electron transport coefficients (mobility, diffusivity and electric conductivity) are calculated according to the electron collisions with heavy particles. Quasi-neutrality is assumed for the bulk of plasma and sheath model is employed to account for the near electrode phenomena. This model is validated for arc discharges at near equilibrium conditions, and the comparison with the equilibrium model is discussed.

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