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Calculation of thermodynamic and transport properties of thermal plasmas based on the Cantera software toolkit CHARLES DOIRON, KAI HENCKEN, ABB Switzerland LTD, Corporate Research — Computational fluid-dynamic simulations nowadays play a central role in the development of new gas circuit breakers. For these simulations to be reliable, a good knowledge of the pressure and temperature-dependence of the thermodynamic and transport properties of ionized gases is required. A key ingredient in the calculation of thermodynamic properties of thermal plasmas is the calculation of the chemical equilibrium composition of the gas. The general-purpose, open-source software toolkit Cantera provides most functionality required to carry out such thermodynamic calculations. In this contribution, we explain how we tailored Cantera specifically to calculate material properties of plasmas. The highly modular architecture of this framework made it possible to add support for Debye-Hückel non-ideality corrections in the calculation of the chemical equilibrium mixture, as well as to enable the calculation of the key transport parameters needed in CFD-based electric arc simulations: electrical and thermal conductivity, viscosity, and diffusion coefficients. As an example, we discuss the thermodynamic and transport properties of mixtures of carbon dioxide and copper vapor.

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