Abstract Submitted
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Direct numerical simulations of an arc-powered heater for used in a hypersonic wind tunnel[1] PILBUM KIM, MARCO PANESI, JONATHAN FREUND, The Center for Exascale Simulation of Plasma-Coupled Combustion, University of Illinois at Urbana-Champaign — We study a model arc-heater using direct numerical simulations, in a configuration motivated by its used to generated inflow of a high-speed wind tunnel for hypersonics research. The flow is assumed to be in local thermal equilibrium (LTE) and is modeled with with 11 species (N_2 , O_2, NO, N, O, N_2^+ , O_2^+ , NO^+, N^+, O^+, e^-). The flow equations are solved in conjunction with an electrostatic field solver and the gas electric conductivity in LTE. The flow rate and the mean arc power are set to be 50.42 g/s and 84.7 kW with 214.0 V of the mean arc voltage , respectively. We study the flow details, the heading and thrust mechanisms, and make general comparisons with a corresponding, though geometrically more complex, experimental configuration. We particularly interested in the radical species it produces and will potentially be present in the wind-tunnel test section.

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