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Study of a microwave plasma torch K. GADONNA, O. LEROY, C. BOISSE-LAPORTE, P. LEPRINCE, LPGP, CNRS/UPS, Orsay, France, L.L. ALVES[1], IPFN/IST, Lisboa, Portugal — The axial injection torch (AIT) [1] produces high-density plasmas (∼1 cm length and 1 mm radius) by coupling a flowing gas (a few L/min at atmospheric pressure) to microwave power (500-900 W) at 2.45 GHz frequency. Our study is about both experiment and modeling of an AIT running in helium, to understand the distribution of its electromagnetic field, the flow of the gas/plasma system, and the plasma-to-gas heat transfer. Modeling wants to describe the gas/plasma system in terms of its density, velocity and energy, by coupling three calculation modules: (i) electromagnetic (3D), which solves Maxwell's equations considering the permittivity of the different media; (ii) hydrodynamic (2D), which solves the Navier-Stokes' equations for the gas/plasma system; and (iii) plasma (1D), under development still, which solves the fluid-type equations for the plasma electrons and ions. Experiments have a double purpose: to obtain input data for the model and to validate its results. Optical emission spectroscopy diagnostics allow obtaining the electron density and temperature (n_e ∼5x10^{14} cm^{-3}, T_e ∼2x10^4 K), and the gas temperature (T_g ∼3x10^3 K).

[1] M. Moisan, G. Sauvé, Z. Zakrzewski, J. Hubert, Plasma Sources Sci. Technol. 3, 584 (1994)

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