Abstract Submitted
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Correlating Metastable-Atom Density, Reduced Electric Field, and Electron Energy Distribution in the Early Stages of a 1-Torr Ar Discharge[1] S.H. NOGAMI, J.B. FRANEK, M.E. KOEPKE, V.I. DEMIDOV, West Virginia University, E.V. BARNAT, Sandia National Laboratories — Measurements of electron density, metastable-atom density, and reduced electric field are used to approximate reaction rates [1] for electron-atom collision excitation in a 1-Torr positive column of Ar plasma. This allows us to relate the observed 420.1nm to 419.8nm line-intensity ratio to plasma parameters by invoking a plausible assumption regarding the shape of the electron energy distribution function (EEDF) throughout the discharge [1]. We show that these reaction rates agree well with experimental observations in the late stages of the pulse and we address discrepancies in the initial and transient phases of the discharge. We examine three assumptions made in the model to see if they are violated in any stage of the discharge: (1) The stepwise excitation from the 1s4 and 1s2 resonant states is negligible; (2) The numerical model designed for a 5-mTorr plasma is applicable to a 1000-mTorr plasma; and (3) The EEDF is bi-Maxwellian and is modified only slightly due to the presence of electrons or metastable-atoms. We conclude that diagnostic signatures for electron density, metastable-atom density, and reduced electric field can be quantitatively interpreted by this correlation at all stages of the discharge.

[1] Adams, et al. Phys. Plas. 19, 023510 (2012).

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