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Investigation of a medium-pressure Xe discharge in pulsed mode
MYKHAYLO GNYBIDA, DETLEF LOFFHAGEN, DIRK UHRLANDT, INP Greifswald, Felix-Hausdorff-Str. 2, 17489 Greifswald, Germany — The pulsed positive column in xenon plasmas at conditions of the contracted discharge has been studied by means of a time-and radial-dependent fluid model. The self-consistent model comprises the particle balance equations for the relevant species, the balance equation of the mean electron energy and the heavy particle temperature in the plasma, the Poisson equation for the radial space-charge potential, and a current balance determining the axial electric field. About 80 collision processes as well as 12 radiative processes are included in the collisional-radiative model. The electron transport and rate coefficients have been applied in dependence on the mean energy of the electrons, heavy particle temperature and ionization degree. Model calculations have been carried out for xenon plasmas in a discharge tube with an inner diameter of 6.5 mm at currents between 60 and 150 mA and pressures from 10 to 50 Torr. The main features of the pulsed xenon discharge at medium pressure are discussed. The results have been compared with experimental data of the axial electric field and of excited xenon atom densities. The agreement is well for the electric field. The model results reproduce the significant increase of low-lying (metastable and resonance) atomic levels densities in the afterglow phase of the pulse, which has also been observed in the experiments.

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