

Model of the Pulsed Discharge Nozzle

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Model Study of the Pulsed Discharge Nozzle W.J.M. BROK, B.H.P. BROKS, J. REMY, J.J.A.M. VAN DER MULLEN, Eindhoven University of Technology, EPG TEAM — The characteristics of the plasma generated by a pulsed discharge slit nozzle (PDN) are investigated. The PDN source was designed to produce and cool molecular ions, creating an astrophysically relevant environment in the laboratory. A discharge model is applied to this system to provide a qualitative as well as a quantitative picture of the plasma. We find that the plasma's properties and behaviour are characteristic of that of a glow discharge. The model describes the electron density and energy, as well as the argon ion and metastable atom number density. The results reveal a high abundance of metastable argon atoms in the expansion region, which is more than one order of magnitude higher than the abundance of electrons and ions. These findings confirm experimental observations, which concluded that large molecular ions are dominantly formed through Penning ionization of the neutral molecular precursors seeded in the supersonic expansion of argon gas. The simulations presented here will help optimise the yield of formation of molecular ions and radicals in the PDN source; they will also provide key physical insight into the characteristics of interstellar molecules and ions analogs in laboratory experiments.

Prefer Oral Session
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