

Gridded retarding pressure sensor for ion and neutral particle analysis in flowing plasmas

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Although classical electrostatic plasma probes can provide detailed information regarding electrons and ions, these devices rely on charge-carrying particles both for energy filtering and for detection. Neutral particles are transparent to such diagnostics. In light of this a new probe design was developed to provide a measurement of the neutral particle flux component of a flowing plasma. The simple design adopted for this probe utilizes a set of electrostatic retarding grids to remove the charged particles from the flow. The neutral particles are sensed within the tube of an off-the-shelf hot cathode ionization gauge. Additionally, by varying the potential on the retarding grids, this same probe configuration can be used to measure the ion energy distribution. Preliminary data from this probe were taken in the exhaust plume of a Hall-current accelerator designed for space propulsion. This probe was found to be a very simple, accurate diagnostic tool for such use. By using this probe in combination with interrelated diagnostics the spatial distribution of energetic charge exchange neutrals was quantified in the plume of an SPT-100 thruster using an electrostatic analyzer.