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# Study of Electron Current Extraction from a Radio Frequency Plasma Cathode Designed as a Neutralizer in Ion Source Applications

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Plasma cathodes have been introduced in recent years as an alternative for the hollow cathodes in electric propulsion applications. These types of electron sources use a bulk plasma generated inside the device chamber to extract electrons. Because of its compact geometry, high efficiency, and easy generation, the RF plasma has been considered as a preferable source to be employed in plasma cathode devices. A radio frequency plasma cathode is designed and manufactured at the Bogazici University Space Technologies Laboratory (BUSTLab) to be used as a neutralizer and an electron source for the various ion thrusters (ion sources) developed at BUSTLab. RF plasma cathode is capable of being switched on instantaneously, compared to the hollow cathode that takes considerable time to be operational. It also does not include an insert material which causes serious lifetime problems in the operation of hollow cathode.

In this study, the successful design and manufacturing process of an RF cathode are presented. The effect of the various design parameters, such as chamber geometry and orifice dimensions, as well as the operational parameters, such as applied RF power and gas flow rate, on the plasma generation inside the device and the electron beam extraction from it are broadly studied. With the use of a home-built double Langmuir probe, RF plasma parameters (electron density and electron temperature) inside the RF plasma cathode are measured at various operational conditions of the device. In addition, the extracted electron current measurements are presented, and the most efficient design parameters and operational conditions are determined.