Characteristics of RF-produced, high-density plasma with very small diameter

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Operation lifetime of conventional electric propulsion systems for a long-term space mission is limited by damage of electrodes contacting directly with a plasma. To solve this problem, we have proposed electrodeless plasma propulsion systems using a high-density (~ $10^{13}$ cm$^{-3}$) helicon plasma.

However, understandings of characterization of a helicon plasma with a small diameter and/or a wide range of an applied RF frequency are not enough. In addition, to decrease weight and space of propulsion system, a small-diameter with simple system is required.

To meet this, we have developed Small Helicon Device (SHD), as shown in Fig. 1, and measured RF power dependence (Fig. 2) and axial distribution of electron density (> $10^{12}$ cm$^{-3}$), using a very small diameter (5, 10 and 20 mm) and a wide range of RF frequency (7~ 70 MHz).