



Plasma Production and Stability in Electron Cyclotron Resonance Source
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Electron cyclotron resonance (ECR) microwave (MW) plasma source has been developed and being tested for radical ion production. The system supplies hydrocarbon molecules through chemical sputtering process on a graphite target immersed in hydrogen plasma. A spiral microwave antenna excites the plasma locally making the antenna structure and distance between the antenna position and the graphite sputtering target important parameters that decide system's overall plasma production efficiency and stability.

Figure 1 shows the shape of plasma glow observed right beneath the gas injection unit with solid carbon disk placed on its nozzles. A cylindrical Langmuir probe was inserted radially (perpendicular to the magnetic field) into the processing chamber near the shown region to measure the current and its variation with respect to antenna configuration. The analysis of I-V characteristics measured by the probe is presented in figure 2.

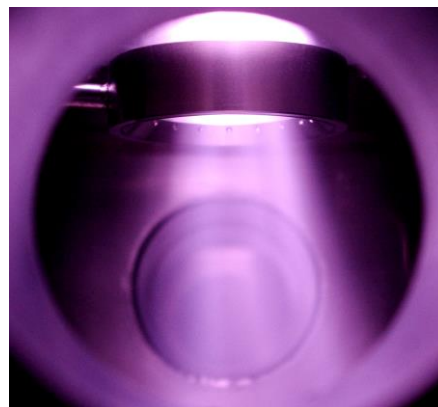


Fig. 1. Plasma glow near the region of the graphite target. The tip of the Langmuir probe has been positioned at the center.

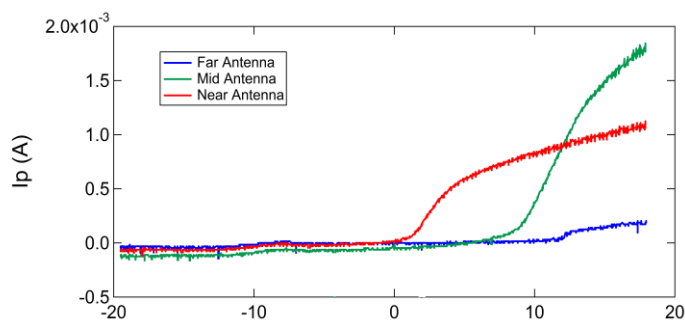


Fig. 2. Langmuir probe trace at three antenna and sputtering target distances at 10 Pa H₂ working pressure

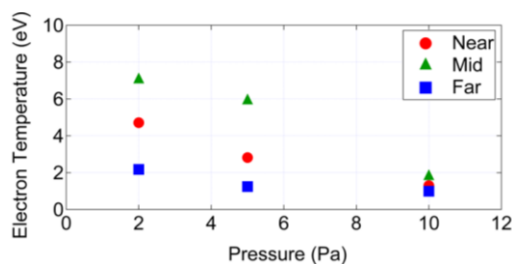


Fig. 3. Electron temperature of the plasma as a function of H₂ working pressure

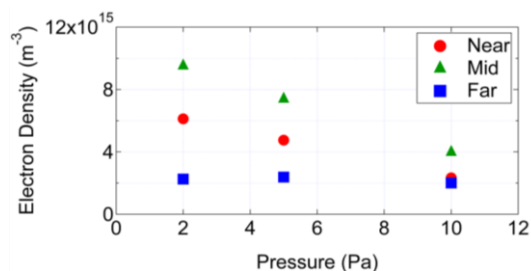


Fig. 4. Electron density of the plasma as a function of H₂ working pressure

The stability of the ECR excited plasma can be characterized through the behavior of the obtained probe traces.

Figure 3 and 4 show the electron temperature and density at varying H₂ pressure, respectively. The result provides information of the controllability of the reactive and neutral species that are known to be important in plasma chemical processes.