



Contribution ID: 28

Type: **Poster presentation**

Emission Spectroscopy Diagnostics of Quartz-chamber 2.45 GHz ECR Ion Source at Peking University

Monday 16 October 2017 18:45 (15 minutes)

A quartz-chamber 2.45 GHz ECR ion source was designed for diagnostic purpose at Peking University [Patent Number: ZL 201110026605.4]. It can produce a maximum of 84 mA hydrogen ion beam working at pulsed mode and the root-mean-square (RMS) emittance of this proton beam is smaller than $0.2 \pi\text{-mm}\cdot\text{mrad}$. In our primary work, electron temperature and electron density inside the plasma chamber have been measured with the method of line intensity ratio of noble gas. Based on these results, atomic and molecular emission spectroscopy of hydrogen are applied for the determination of hydrogen degree of dissociation and vibrational temperature in the ground state, respectively. Measurements are made at gas pressure range from 4×10^{-4} to 3×10^{-3} Pa and input RF power (peak) range from 1000 to 1800 W. Hydrogen degree of dissociation in the range of 1%-25% and vibrational temperature in the ground state in the range of 3500 K-8500 K were measured. Moreover, plasma processes inside the chamber are discussed based on these results. Details will be presented in this paper.

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Session Classification: Poster Session 1

Track Classification: Fundamental processes