Contribution ID : **432** Type : **not specified**

6.53 Calibration of a Langmuir probe in magnetized plasma using interferometry

Tuesday, 17 April 2018 10:31 (120)

Langmuir probe diagnostic is one of the widely used techniques for plasma parameters measurements. While the construction and installation of a probe usually represent no significant complications, the data analysis encounters multi-layered challenges. All parts of an IV characteristic are bound to more than one plasma parameter, which means that self-consistent calculations are needed and cross errors can never be completely excluded. A theory for data interpretation in the presence of a magnetic field is tested for a cylindrical Langmuir probe in a linear low-temperature plasma device Aline. The probe is placed on a 3D manipulator parallel to the magnetic field direction and a position scan is performed. Tests are done in a capacitive radio-frequency (RF) discharge at 3.5 cm above an RF antenna. Typical RF sheath size around the antenna is in the order of few cm, depending on the neutral gas pressure, coupled power and magnetic field strength, and the sheath region is avoided to exclude strong RF perturbations. Using the theory electron densities are obtained from the current values at the plasma potential. Results are calibrated by line-integrated density measurements of a 26.5 GHz microwave interferometer MWI 2650 from Miwitron and reasonable agreement is observed.

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Session Classification : Session #6, Tuesday Morning Poster Session