



A dc biased hairpin probe to diagnose plasma parameters in an electronegative plasma

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The hairpin resonator probe or simply hairpin probe (HP) is fundamentally based on the resonance condition in a quarter-wave parallel wire transmission line, whose characteristic resonance frequency depends on the effective permittivity of the medium surrounding the probe-tips [1]. Therefore as the probe is inserted inside plasma medium, the resonance frequency registers a shift towards higher value, which is directly proportional to the absolute electron number density [2]. The main advantage of the HP is that very accurate and reliable measurements of electron density can be obtained in low-pressure plasma discharges.

The HP assisted with laser photo detachment has been extensively used to determine density and temperature of negative ion in an electronegative discharge [3]. However, the single use of hairpin probe is

only limited to determine the electron density for the past few decades. Here, we have developed for the first time, a dc biased HP to determine the electron temperature and negative ion concentration in an oxygen discharge by varying the cylindrical sheath around the HP. The sheath thickness around the cylindrical wire of the HP is also determined without additional probes which is otherwise difficult due sheath dimension being extremely small.

References:

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