

Effects of the Sheath on Determination of the Plasma Density of Microwave Probe

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The microwave probe for measuring plasma density is widely used for its advantages: First, it is not affected by the reactive gas. Second, it can measure local plasma parameters such as plasma density, plasma potential and plasma temperature. Third, it is simple and robust. A cut-off probe is the one of the most promising microwave probe. Recently, Kim et al. reveals the physics of the cut-off probe but the effect of the sheath on the determination of the plasma density is not explained. In this presentation, for taking account of sheath effects on determination of plasma density from the cut-off peak, a simplified circuit modeling and an E/M simulation are conducted. The results show that occupation ratio of sheath volume between two tips of the cut-off probe and sub-sequence pressure condition mainly change position of the cut-off peak with respect to plasma frequency. Magnitude of relative voltage taken on the impedance of sheath and the impedance of bulk plasma can explain this effect. Furthermore, effects of gap size, tip radius, and tip length were revealed based on above analysis.

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