Detail relation of negative ion density with positive ion mass and sheath parameters

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Negative ions are generated in fusion edge plasmas, material processing plasmas, ionospheric plasmas. Analytic formulas for the deduction of the absolute density of negative ions was given by using the current-voltage(IV) characteristics of two electric probes at two different pressures [1], and negative ion density has been measured by one electric probe using the current-voltage characteristics of three different pressures [2]. Ratios of ion and electron saturation currents and electron temperatures and sheath areas of different pressures are usually incorporated into two equations with two unknowns for the negative ion density. In the previous publications, the sheath factor(sheath area, sheath density, sheath velocity) and effective masses of background ions with differenct pressures are qualitatively incorporated for the deduction of negative density. In this presentation, the quantitative and detailed relation of negative ion density with sheath factor and effective masses are going to be given. The effect of these parameters on the change of IV characteristics will be addressed.

[1] K.-S. Chung and S. Kado, Phys. Plasmas 13, 104509 (2006).
[2] S.Y. Kang, T.H. Chung and K.-S. Chung, Rev. Sci. Instrum. 80, 013502 (2009).

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