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Mass Dependent Impurity Transport Study in ADITYA Tokamak

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The investigation of impurities and its transport study in tokomak plasma play a vital role in determining the overall plasma performance. It is important to understand the transport of impurities in tokamak plasmas in order to control impurity inside the plasma and its deleterious consequences affecting overall plasma performance. In Aditya, strong boron like carbon lines are usually seen in visible range due to the interaction of plasma with graphite limiters. A 1.0 m multi-track spectrometer (Czerny–Turner) capable of simultaneous measurements from eight lines of sight has been used for measuring the radial profiles of C+ (657.805 nm, 3s 2S1/2–3p 2P°3/2 and 658.288 nm, 3s 2S1/2–3p 2P°1/2). The carbon transport coefficients are determined by modeling the experimentally measured emissivity profiles of C+, using a one-dimensional empirical impurity transport code, STRAHL . This code has been earlier also used for studying the oxygen impurity transport in Aditya which reveals a higher values of the diffusion coefficient compared with the neo classical values in both the high magnetic field edge region (Dmax inboard~30 m2s−1) and (Dmax outboard~45 m2s−1) in the low magnetic field edge region[1]. Similar studies are carried out for neon by injecting neon using neon spectral lines in the UV/visible region at the plasma current flat-top.

In this paper, we compared the transport coefficients of all the three impurity species, i.e., carbon, oxygen, neon etc., through the modeling (using STRAHL code) of experimental emissivity profiles recorded in the typical discharges of Aditya tokamak. The transport coefficients for these species are determined by minimizing the residual error between the measured and calculated emission profiles for all the three species. By comparing the diffusion coefficient of three species, understanding the mass dependency of impurity transport has been attempted in Aditya tokamak.

References:
[1] M.B. Chowdhuri et al 2013 Nucl. Fusion 53 023006.

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