Estimation of oxygen transport coefficients using the O^{4+} visible spectral line in the Aditya tokamak

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Abstract

To investigate the oxygen impurity transport in typical discharges of Aditya tokamak, spatial profile of brightness of Be-like oxygen (O^{4+}) spectral line (2p3p $^3D_3$-2p3d $^3F_4$) at 650.024 nm is recorded using a 1.0 *m* multi-track spectrometer (Czerny-Turner) capable of simultaneous measurements from eight lines of sights. The emissivity profile of O^{4+} spectral emission is obtained from the spatial profile of brightness using an Abel-like matrix inversion. The oxygen transport coefficients are then determined by reproducing the experimentally measured emissivity profiles of O^{4+}, using a one-dimensional empirical impurity transport code, STRAHL. After calculating the density profile of each charge state, the emissivity of the particular transition, 2p3p $^3D_3$ - 2p3d $^3F_4$, at 650.024 nm is estimated from $\varepsilon_{z,i,j}(r) = n_{z,i}(r).n_e(r).PEC_{z,i,j}(r)$, where n_z and n_e are the impurity and electron densities and PEC is the photon emissivity coefficient. The PEC values depend on both electron density and temperature and are obtained from database ADAS. Much higher values of diffusion coefficient compared to the neo-classical values are observed in the high and low magnetic field edge regions of typical Aditya Ohmic plasmas. The diffusion coefficients are recalculated using PEC values from NIFS atomic database. The estimated diffusion coefficients using PEC values from both the databases are then compared with those calculated from the fluctuation induce transport. Although similar profiles for diffusion coefficients are obtained using PEC values from both databases, the magnitude differs.