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Study of Iron Impurity Behavior using VUV Spectroscopy in Aditya and Aditya-U Tokamak

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Studies of medium and high Z impurities behavior in high temperature tokamak plasmas have become important considering molybdenum, tungsten are being considered as the first wall materials due to its high melting points and capabilities to handle high heat load. These impurity ions are present due to mainly sputtering processes involving plasma facing components in contact with the edge plasma. Presence of such spectrum of impurities leads to enhanced energy loss, fuel dilution and overall degradation of plasma properties. Thus the study of the behavior of impurities is carried out in Aditya and Aditya–U tokamak. VUV spectra from impurities is regularly monitored using a absolutely calibrated VUV survey spectrometer having operation in the spectral range of 10-180 nm, which covers the important lines of partially ionized low and medium-Z impurities and also emissions from higher excited states of highly ionized low-Z impurities. Absolute intensity calibration of this system has been carried out using branching ratio and by simulating the VUV spectra and then comparing those with experimental counts. VUV spectral lines at 28.41 nm (3p6 3s2 1S0 - 3s 3p 1P1) from Fe14+ and, 33.54 nm (2p6 3s2 2S1/2 - 2p6 3p 2P3/2) and 36.08 nm (2p6 3s2 2S1/2 - 2p6 3p 2P1/2) from Fe15+ are measured during the current flat-top region of Aditya and Aditya-U tokamak plasmas. The behavior of iron emission has been studied with respect to plasma parameters and its measured penetration into the plasma has been compared with simulated spectral emissions by taking the impurity transport and relevant atomic data generated using ADAS database.

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Author: Mr PATEL, Sharvil (Birla Institute of Technology, Jaipur Campus , India)

Co-authors: Ms BHATTACHARYA, AMRITA (INDIAN INSTITUTE OF TECHNOLOGY KANPUR); Dr SRIVASTAVA, Anand Kumar (Birla Institute of Technology, Mesra (Ranchi), Jaipur Campus); Dr GHOSH, Joydeep (Institute for Plasma Research); Dr CHOWDHURI, Malay Bikas (Institute for Plasma Research); Mrs MANCHANDA, RANJANA (INSTITUTE FOR PLASMA RESEARCH)

Presenter: Mr PATEL, Sharvil (Birla Institute of Technology, Jaipur Campus , India)

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