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Spectroscopic Analysis for impurities and Plasma parameters in Metallic Spherical Tokamak (MT-I)

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Metallic Spherical Tokamak (MT-I) is modified form of the GLAST-II (GLAss Spherical Tokamak) operational in PTPRI at Pakistan. It has major radius 15 cm and minor radius 9 cm with aspect ratio 1.67. It is equipped with optical, electrical and magnetic diagnostics. Impurities present in the vacuum vessel disturb the performance of the device and hinder the achievement of the higher values of plasma parameters such as electron number density, electron temperature, plasma stability, and global energy confinement due to plasma cooling by radiative losses. The temporal concentration of the nitrogen impurity present in the Ar and He discharge during the wall conditioning of the MT-I tokamak is determined through emission spectrum. Optical actinometric technique exploits the change in emission intensity of the selected Ar/He lines at constant partial pressure to normalize the electron energy distribution function. The changing plasma conditions provided that both transitions have close excitation thresholds and similar dependence of excitation cross-sections. The selected line intensity of the nitrogen can be related to the ground state concentration of the nitrogen molecules and ions involving in optical emission. The electron temperature for both discharges has been determined separately from the Boltzmann plot method. For measurement of electron number density empirical formulas have been derived from the isolated spectral lines of Ar–I (750.38 nm) and He–I (587.56 nm & 667.81 nm). Stark broadening of well-isolated argon Ar–I (750.38 nm) and helium He–I (587.56 nm & 667.81 nm) lines have been used after de-convolution of other broadening contributions. A newly designed optical diagnostics consists of three channel photodiodes coupled with the extreme narrow band filters have been developed to obtain the temporal profile of Hα and Hβ spectral lines during the hydrogen discharge in the MT-I Tokamak. The line ratio method is used to calculate the temporal profile of the electron temperature considering the emission intensities of the Hα and Hβ spectral lines with excitation thresholds energies.

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