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Spectroscopic investigation of discharge cleaning and pre-ionization phases in MT-I spherical tokamak

Optical emission spectroscopy is among the prime plasma diagnostic techniques to realize practically the changes that occurred in spectral intensity, electron temperature, electron number density, and impurity concentration. The optical actinometric technique is applied to investigate the addition of impurities in the argon and helium microwave discharges during the wall conditioning process of the MT-I spherical tokamak. This technique incorporates the change that occurred in the electron energy distribution function with changing plasma conditions through emission intensity of the selected Ar/He lines. The change in relative spectral intensities correlates with the group of electrons involved in the electron impact excitation and plasma species producing the optical emission. The study investigates the impurity level and the change occured in the electron temperature and electron density by using relative intensities, Boltzmann plot and stark broadening of the selected Ar/He lines. Optimization of the pre-ionization phase is also a necessary step before switching to the main tokamak operation. The sequential imaging of the electron cyclotron resonance (ECR) heated plasma zones displays their growth and progression. At lower fill pressure, plasma imaging illustrates the two distinct ECR heated plasma zones corresponding to the first and second harmonics. The studies provide insights into the physics of preferential plasma heating in space and time-varying magnetic fields producing ECRH zones.

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