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Recent ICRH-Wall Conditioning, Second Harmonic Heating and Disruption Mitigation Experiments Using ICRH System in Tokamak ADITYA

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ADITYA is a medium size tokamak with major radius 0.75 m and minor radius of 0.25 m, with toroidal magnetic field up to 1.5 T and has circular plasma in hydrogen gas. The diagnostics used in ICRH experiments are Langmuir probes, visible camera, spectroscopy, soft X-ray and hard X-ray detection techniques, diamagnetic loop, heterodyne on-line density measurements, Thompson scattering, Neutral particle analyzer, Limiter thermography, Residual Gas Analyzer(RGA), microwave diagnostics along with normal machine diagnostics like loop voltage, position and plasma current measurements. The indigenously developed ICRH system is installed on ADITYA having 1 MW RF generator in the frequency range of 20-40 MHz, transmission line with matching system, vacuum interface and fast wave poloidal type antenna with Faraday shield.
Here we report the recent experiments carried out on tokamak ADITYA using the developed ICRH system of 1 MW at 24.8 MHz frequency. The experiments are carried out to have plasma heating at second harmonic, disruption mitigation and also wall conditioning in presence of toroidal magnetic field.
The wall conditioning experiments are carried out in presence of toroidal magnetic field under resonant (0.75T), non-resonant (0.45 T) conditions as well as with 20% He gas in a hydrogen plasma (0.45T). All three sets are found more effective in releasing wall impurities like water & methane as half an order (˜ 5) of initial vacuum condition. As per data, the resonant ICWC is more effective to reduce carbon impurity and non-resonant ICWC is more effective to reduce oxygen impurity from vessel.
The heating experiments at second harmonic are carried out using RF pulses of different magnitudes (5 ms-100 ms) at different RF powers (40 kW-200 kW) in plasma duration of 100 ms. The soft X-ray data shows an electron temperature rise from 250 eV to maximum of 500 eV and NPA data as well data from Doppler broadening shows the ion temperature rise up to 350 eV.
In order to carry out mitigation of disruptions induced by hydrogen gas puff, ICRH system was used in both fixed and real time feedback mode. In an attempt to control the disruptions in real time the gas-puff induced H intensity increase is used as a precursor for the disruption and mitigation is successfully carried out.

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