

Overview of Operation and Experiments in the ADITYA-U Tokamak

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Ohmically heated circular limiter tokamak, ADITYA has been upgraded to a tokamak named ADITYA Upgrade (ADITYA-U) having open divertor configuration with divertor plates. Experiment research in ADITYA-U ($R_0 = 75$ cm, $a = 25$ cm) has made significant progress, since last FEC 2016. After successful commissioning of ADITYA-U, the Phase-I plasma operations have been conducted from December 2016, with graphite toroidal belt limiter. Filament pre-ionization assisted purely Ohmic discharges with circular plasma have been obtained. Hydrogen gas breakdown has been obtained in each of ~ 700 discharges without a single failure. Repeatable plasma discharges of plasma current ~ 80 kA – 95 kA, duration ~ 80 – 100 ms with toroidal magnetic field (max.) ~ 1 T and chord-averaged electron density $\sim 2.5 \times 10^{19} \text{ m}^{-3}$ has been achieved. Later, the discharge duration has been enhanced up to ~ 180 ms with the application of negative converter along with better wall conditioning, achieved by implementing the Glow Discharge Cleaning (GDC) with Ar: H₂, He: H₂ gas mixture and with intense short plasma pulses in ECR produced plasma background. Being a medium sized tokamak, runaway electron generation, transport and mitigation experiments have always been one of the prime focus of ADITYA-U. MHD activities and density enhancement with H₂ gas puffing has also studied. The Phase-I operation was successfully completed in March 2017.

The Phase-II operation preparation in ADITYA-U includes, calibration of magnetic diagnostics followed by commissioning of major diagnostics and installation of baking systems. After repeated cycles of baking the vacuum vessel up to $\sim 130^\circ\text{C}$, the ADITYA-U Phase-II operations have been resumed from February 2018 and is continuing in order to achieve plasma parameters close to the design parameters of circular limiter plasmas using real time plasma position control. Several experiments, including the fueling with Supersonic Molecular Beam Injection, H₂ gas puffing for runaway control during current flat-top and disruptions, Neon gas puff assisted radiative improved confinement and the experiments related to plasma shaping is undergoing. The complete upgradation including dismantling of ADITYA and reassembling of ADITYA-U along with experimental results of Phase-I and Phase-II operations from ADITYA-U and overall progress will be discussed in this paper.

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