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Preliminary Results of Wall Conditioning Experiments using High Power ICRH System on SST-1 at Different Toroidal Magnetic Fields

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Proper wall conditioning has turned out to be an essential element for achieving the highest possible plasma performance in present-day fusion devices. The main issues are controlling the generation of plasma impurities, liberated by plasma-surface interactions. Superconducting fusion machines need efficient wall conditioning techniques for routine operation in between shots in the presence of high toroidal magnetic field for wall cleaning to control the in-vessel impurities. Ion Cyclotron Wall Conditioning (ICWC) is fully compatible with steady-state tokamak in presence of magnetic field.

Here we report the preliminary results of ICRF wall conditioning experiments done on Steady State Superconducting Tokamak (SST-1) using High Power Ion Cyclotron Resonance & Heating (ICRH) System indigenously developed including MW RF generator, Transmission Line with Matching System, Vacuum Transmission Line (VTL) and Fast Wave Poloidal Antenna with Faraday shield.

In the first stage, the experiments are conducted to condition the complete system and antenna by introducing low power RF pulses in the SST-1 machine. It is observed that the conditioning pulse removes gas species from Antenna and VTL. In the second stage, the wall conditioning experiments are conducted at 0.2 - 0.4 T and in third stage the wall conditioning experiments are conducted at 1.5 T in Helium gas. The diagnostics used are the visible camera, spectroscopy, Residual Gas Analyzer (RGA) etc. More than 600 RF pulses of 150 kW with 0.5 seconds on time and 0.8 Seconds off time were introduced and significant impurity generation is observed from antenna and vacuum vessel. It is observed that RF conditioning at low pressure releases H2 and other gas species.

The previous ICWC experiments done on Aditya tokamak show that in presence of toroidal magnetic field (0.45 T) conditions as well as with 20% Helium gas in a hydrogen plasma is found more effective in releasing wall impurities like water & methane as half an order (~ 5) of initial vacuum condition.

The preliminary results on SST1 show that the ICWC in the presence of magnetic field seems to be effective and can be used an alternative method for vessel wall conditioning. In this paper, the above-mentioned experiments and results will be discussed.

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