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RGA Analysis and Surface Analysis of SST-1 Graphite Tiles in High Temperature Vacuum Baking

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Steady state Superconducting Tokamak (SST-1) is a large aspect ratio Tokamak with a major radius of 1.1 m and minor radius of 0.20 m. Plasma Facing Components (PFC) is one of the major sub-systems of SST-1 Tokamak. Plasma Facing Components of SST-1 consists of divertors, passive stabilizers, baffles and poloidal limiters. PFCs are designed and fabricated to be Ultra High Vacuum (UHV) compatible and high temperature compatible for steady state plasma operation. All PFCs are made up of graphite tiles mechanically attached to the copper alloy substrate. Graphite is chosen as a first wall armour material in SST-1 Tokamak because of its high thermal shock resistance and low atomic number of carbon. Graphite, because of its porous nature absorbs water vapour and other gasses from atmosphere. Generally graphite tiles are given a high temperature bake-out treatment prior to installation inside the tokamak to reduce the in-situ wall conditioning period. There are about 3800 numbers of graphite tiles of different sizes to be fitted on 132 numbers of PFC copper modules. All the 3800 graphite tiles were given a high temperature bake-out at 1000 oC to remove the entrapped gasses, under high vacuum in a vacuum furnace before installation into the SST-1 vacuum vessel. Residual Gas Analyser (RGA) was used to measure the outgassing at various temperatures during the entire vacuum baking process. RGA works on the principle of Quadrupole Mass Spectrometer. RGA is used to detect and analyse the residual gases during vacuum pumping and high temperature baking of graphite tiles. Surface analysis of graphite tiles have been carried-out using Scanning Electron Microscope (SEM) and X-Ray Diffraction analysis (XRD) before and after baking. Elemental analysis was also carried-out before and after baking to qualify the graphite samples. This paper will discuss about the residual gas analysis and surface analysis of SST-1 graphite tiles in high temperature vacuum baking process.

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