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Modeling studies of X-divertor configuration on SST-1 tokamak using SOLPS5.1

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To solve the challenging problem of heat removal in a tokamak based fusion reactor, several advanced divertor configurations have been proposed and studied. We present here the reults of our studies of one of the more promising configurations, the X-divertor, conducted for the parameters of the Indian tokamak SST-1. Using the equilibrium code CORSICA, we develop the appropropraite magnetic geometry and then study its performance using the Scrape-Off Layer plasma transport code package SOLPS5.1/B2.5-Eirene. One of the main motivation was to find out if the X-divertor (XD) could boost the heat handling capacity as compared to the standard divertor (SD) configuration for SST-1 that designed to handle 1 MW of total input power. In order to compare the performance XD with the existing SD, we first ensured the core equivalence of both configurations. An additional poloidal field coil was placed behind the divertor target to produce XD configuration. The plasma equilibrium for SD and XD are generated. The divertor index (DI) is varied from 2 to 13. For a plasma operation with P=1 MW input power and plasma edge density ne = 1x1019 m-3 , the peak heat load on the target plates in the X-divertor configuration has reduced by 50% as compared to standard divertor; the heat flux profile near the separatrix was also broadened due to flaring of field lines. The latter increases the plasma-wetted area at the targets. This is a preliminary demonstartion that XD will allow SST-1 to operate at higher input power.

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