Initial Results from the DIII–D Divertor Experiments With Independent Pumping of Divertor Strike Points*

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A major upgrade of the DIII–D divertor has been successfully completed. The main goals of this upgrade are density, impurity, and heat flux control in standard tokamak plasmas and Advanced Tokamak (AT) plasmas with double-null configuration and rf current drive. The new upgrade includes a high-field side cryopump, a baffle structure in the private flux region (septum), and a new design for the inner wall graphite armor. The new pump is at the top of the vessel and, together with a previously installed low-field side cryopump and baffle, allows independent or simultaneous pumping of the divertor legs. Earlier experiments on DIII–D have shown the importance of forced scrape-off layer (SOL) flows on divertor impurity enrichment and achieving densities above the Greenwald limit. The flows are generated by simultaneous divertor pumping and gas fueling away from the divertor. Pumping both legs of the divertor allows larger SOL flows towards the divertor plates. Therefore, we expect to achieve more effective divertor impurity enrichment in lower density AT plasmas. Enhanced SOL flows should also facilitate access to high density H–mode for a wider range of plasma parameters than currently possible. Dual pumping with feedback will be used to symmetrize divertor heat flux in both attached and detached plasmas. The septum combined with divertor pumping will be employed to reduce recycling and improve density control. UEDGE modeling shows that the septum and the existing outer baffle together will reduce core plasma neutral source by a factor of 9. The new armor graphite tile design, with 1-mm gap between adjacent tiles and height variations no greater than 0.1 mm, takes advantage of the two dimensional heat conduction to reduce the temperature of tile edges. Calculations show that the temperature of tile edges in a great majority of long pulse high power plasmas conditions will not exceed the radiation enhanced sublimation threshold. We will present results of a series of experiments designed to test the performance of the system for divertor and density control in AT plasmas.

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