Power deposition on the DIII-D inner wall limiter*

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Power deposition, q_{dep}, on the Inner Wall Limiter (IWL) of DIII-D, was measured by IR thermography and calculated from plasma profiles measured by probes and Thomson scattering (TS). High field side (HFS) swing-probe data were obtained for 6 discharges with κ=1.25, 1.6 and I_p=0.6, 1.2 MA; for some cases the presence of a short-λ_q component was indicated. The low field side (LFS) TS showed no indication of a short-λ_q component based on 20-80 data points per mm, which should be sufficient to detect radial features as small as 1 mm. The objective of the experiment was to check the assumptions made in defining the shape of the ITER IWL, which has been designed to allow limiter start-up and rampdown. The experiment aimed to investigate the specific concern that a narrow feature in the radial decay length, λ_q, of the parallel power flux density, $q_{||}$, seen in other tokamaks [1,2], might also be present in DIII-D, which has an IWL resembling more closely the ITER situation than in other devices. The specific objective was therefore to (i) measure $q_{||}$ for ohmic discharges limited on the HFS, and (ii) establish whether $q_{||}$ can be adequately represented by an exponential profile characterized by a single λ_q, or whether a 2nd short-λ_q component exists adjacent to the last closed flux surface. Although it is generally thought that λ_q is set by plasma turbulence; however, some neoclassical theories predict $\lambda_q \approx \rho^{pol}_{D^+}$ [3-6] which is usually of order a few mm. Such a short-λ_q component could be difficult to observe on the LFS due to the high turbulence there, but might manifest itself on the quiescent HFS. Direct measurements of q_{dep} were made using an IR camera system viewing the DIII-D IWL, which comprises 48 vertical columns of straight tiles approximating a right, vertical cylinder of radius 1 m. Indirect measurements were made using (i) a Langmuir swing-probe on the HFS, (ii) a reciprocating Langmuir probe (RCP) on the LFS, (iii) an RCP entering from the bottom of the poloidal cross-section, (iv) a TS system on the LFS, and (v) a lower TS system. These five diagnostics measured radial profiles of n_e and T_e from which $q_{||}$ was calculated assuming T_e=T_i and γ_{sheath}=7. Results from all the diagnostics will be reported. The IR profiles of q_{dep} are difficult to interpret because complete information of the IWL tile misalignments is required. This information is being provided by high resolution survey measurements in DIII-D, underway.

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