Assessment of Recycling and Core Plasma Fueling in L-mode and ELMy H-mode Plasmas in the DIII-D Tokamak Using Tangentially Viewing CID Cameras *

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Plasma contact with the main wall in fusion devices, and its associated particle recycling and impurity generation, can pose serious constraints for controlling core plasma density and core impurity content. Measurements of the D_α, CII, and CIII poloidal emission profiles in low-density L-mode ($n/n_{GW} \sim 0.2$) and medium-density edge localized mode (ELMy) H-mode ($n/n_{GW} \sim 0.4$-0.6) plasmas in the DIII-D tokamak, using tangentially viewing CID cameras, suggested, however, that the divertor region is the primary source of fuel and impurities. At the high-field side, vertically asymmetric emission profiles were consistently observed in the scrape-off layer (SOL) centered around the equatorial plane for all spectral lines, with the maximum intensity closest to the divertor X-point and exponentially decreasing away from the divertor. For L-mode plasmas, these results, coupled with fluid edge code UEDGE and Monte-Carlo code DEGAS calculations, imply that for divertor recycling sources core plasma fueling is dominated by the region around the magnetic X-point. Agreement between experimental data and modeling was achieved by using a purely diffusive radial transport model in UEDGE without imposing significant recycling from the main walls. Modeling shows that carbon chemically sputtered from divertor region at the central solenoid is transported into the high field side SOL, and subsequently into the core, due to the dominant ion temperature gradient force in the region above the divertor X-point.

The effect on fueling and core impurity content of poloidal **E**x**B** and **B**x∇B drifts, magnetic configuration and geometry divertor was investigated in medium-density ELMy H-mode plasmas. The spatial distribution of the D_α emission in the lower and upper divertor suggests, together with DEGAS modeling, that fueling predominately occurs through the high density, low temperature divertor leg that is produced by the **E**x**B** particle drift in the private flux region. In contrast, CII profiles were dominated by emission from both outer divertor regions only independent of **E**x**B** drift direction.

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