MEASUREMENTS OF DIVERTOR IMPURITY CONCENTRATIONS ON DIII–D*

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In this paper, we determine impurity concentrations and radiative losses in the DIII–D divertor region with an absolutely calibrated UV SPRED spectrograph. The spectrograph covers the 100–1100 Å region with a temporal and spectral resolution of 20 ms and 2 Å, respectively. The instrument has a vertical view of the lower divertor along the same line of sight as a bolometer channel and the eight-chord Divertor Thomson Scattering (DTS) system. The vertical and radial extent of impurity radiation zones are determined from a visible tangentially-viewing TV camera with filters. This diagnostic set enables us to calculate impurity densities and radiated power in the divertor region.

Line intensities of D I, C II-IV, N II-V and Ne IV-VIII were measured using the UV SPRED instrument. These measured line brightnesses along with local measurements of the electron temperature (T_e) and density (n_e) from DTS and excitation rates obtained from the literature are used to calculate the area density ($n_i l$) and the column radiated power (W/cm^2) for each impurity ionization state. For strong transitions that lie outside the wavelength region of the spectrograph, the contributions of the unobserved transitions to the radiated power are determined from a collisional-radiative model. These data are then compared to the total radiated power as measured by the bolometers.

Carbon emissions in the divertor during Radiative Divertor Experiments with D_2 puffing have been measured and the radiated power and the temporal behavior of the impurity emissions from spectroscopy are in good agreement with the bolometer measurements. During these experiments, the T_e measured by DTS along the outer leg of the divertor to the outer strike point is nearly constant (~5 eV), and the carbon emissions are also nearly constant, CIV being the leading contributor to the total radiated power. Carbon emissions contribute approximately 90% to the total radiated power with the balance coming from deuterium emissions. Results during Radiative Divertor experiments with detached plasmas induced by injection of neon and nitrogen will also be presented.

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*Work supported by the U.S. Department of Energy under Contract Nos. DE-AC03-89ER51114 , W-7405-ENG-48, and DE-AC05-84OR21400.

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