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7.4 Utilization of outer-midplane collector probes with isotopically enriched tungsten tracer particles for impurity transport studies in the scrape-off layer of DIII-D

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Triplet sets of replaceable graphite rod collector probes (CPs), each with collection surfaces on opposing faces oriented normal to the magnetic field, were inserted at the outboard mid-plane of DIII-D to understand divertor tungsten (W) transport in the Scrape-Off Layer (SOL). Each CP collects particles along field lines with different parallel collection lengths (determined by the rod diameters and SOL radial transport) giving radial profiles from the main wall inward to $R \sim 6\text{cm}$. Rutherford backscatter spectrometry of the CPs provided areal density profiles of elemental W coverage. Higher peak W content measured on the probe face connected along the field lines to the inner divertor indicate higher concentration of W in the plasma upstream of the CP. The CPs were also used in a first-of-a-kind experiment using isotopically-enriched, W-coated divertor tiles. Laser ablation mass spectroscopy validates the isotopic tracer technique through analysis of CPs exposed during L-mode discharges with the outer strike point on the enriched W tile inserts. Results provided quantitative information on the W source and transport from specific poloidal locations within the lower outer divertor region. US DOE support DE-AC05-00OR22725, DE-FG02-07ER54917, DE-FC02-04ER54698, DE-NA0003525.

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