

DiMES studies of temperature dependence of carbon erosion and re-deposition in the lower divertor of DIII-D under detachment

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ABSTRACT

A strong effect of a moderately elevated surface temperature on net carbon deposition and deuterium co-deposition in the DIII-D divertor was observed under detached conditions. A graphite DiMES sample with a 2 mm wide, 18 mm deep gap lined with silicon catcher plates was exposed to lower-single-null (LSN) L-mode plasmas first at room temperature, and then pre-heated to 200°C by a built-in electrical heater. At the elevated temperature, deuterium co-deposition in the gap was reduced by an order of magnitude. At the plasma-facing surface of the pre-heated sample net carbon erosion was measured at a rate of 3 nm/s, whereas without pre-heating net deposition is normally observed under detachment. In a related experiment three sets of molybdenum mirrors recessed 2 cm below the divertor floor were exposed to identical LSN ELMy H-mode discharges. The first set of mirrors exposed at ambient temperature exhibited net carbon deposition at a rate of up to 3.7 nm/s and suffered a significant drop in reflectivity. In contrast, two other mirror sets exposed at elevated temperatures between 90°C and 175°C exhibited practically no carbon deposition and their optical reflectivity in the wavelength range above 500 nm was essentially preserved.