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Mechanisms for Carbon Migration and Deuterium Retention in Tore Supra CIEL Long Discharges J. HOGAN, ORNL, E. DUFOUR, P. MONIER-GARBET, Y. CORRE, C. LOWRY, R. MITTEAU, J. GUNN, P. THOMAS, E. TSITRONE, CEA-Cadarache — The co-deposition mechanism in long discharges with high extracted power has been modeled in greater detail. A 1D core, 3D scrape-off layer and detailed 3D wall impurity generation model are coupled to follow the C balance in steady state and describe the complex 3D erosion/deposition zones of the realistic Tore Supra CIEL surface, including impurity generation from intra-tile gaps and from the poorly adhered layers of re-deposited material in shadowed areas. Results have been compared with CII/Da spectroscopy for a power scan in a database of 50 discharges. The model reproduces the observed increase in CII emission with power. Sources due to D+ physical sputtering saturate at higher net power levels, while self-sputtering contributions continue to increase. Significantly different scaling trends are predicted for sources due to physical/self-sputtering, and for chemical erosion using flux-independent and empirical flux suppression models. By incorporating IR measurements of local temperature to evaluate chemical erosion rates, contributions due to intra-tile-gap emission are found to be important in enhancing predicted chemical erosion rates. A new mechanism, radiant heating with CX bombardment, causes layer decomposition and transport. This mechanism can produce large scale deposits (flakes) at locations very remote from plasma fluxes.
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