Topic D	Requested: ☐ Oral ☒ Poster	Panel suggestion: ☐ Oral ☐ Poster

Carbon Influx in He and D Plasmas in DIII–D*

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Differences in the carbon behavior between He and D plasmas during VH–mode, ELMing H–mode, and Partially Detached Divertor (PDD) operation will be reported and inferences on the importance of the various carbon sources during these modes of operation will be discussed. In DIII–D, the dominant core impurity is carbon. Because DIII–D has an all carbon wall there are several possible sources for carbon influx, including: 1) physical sputtering from divertor strike points, 2) chemical sputtering from divertor walls, and 3) physical sputtering from main chamber walls by energetic charge exchange neutrals. In some cases the influx is sufficient that carbon becomes the dominant ion in the plasma. Previous work has shown that near the end of a VH–mode phase in a DIII–D discharge carbon can be the dominant plasma ion in the edge region of the plasma ($\rho > 0.7$).[1] During detached divertor operation with D_2 gas puffing, carbon provides the bulk of the radiative loss.[2]

During He plasma operation the effect of chemical sputtering should be greatly reduced. Physical sputtering in the divertor should be reduced at detachment for both He and D plasmas. During a VH–mode phase, VUV and visible charge exchange spectroscopy indicates that for both He and D operation the carbon behavior is very similar. In the edge plasma, carbon build up is quite rapid, and the carbon influx represents a large fraction of the total plasma density increase until the termination of the VH phase. During PDD operation induced by puffing the primary fueling gas, D and He discharges show a difference in the carbon behavior. The core carbon density is seen to be approximately constant during a D discharge as it transitions from an attached to a PDD discharge. However in a He discharge, the core carbon density disappears soon after the PDD transition. These results suggest that in VH–mode physical sputtering is a dominant carbon source, where in PDD mode, chemical sputtering is important. Analysis of high resolution visible spectroscopy as well as 2D images of visible emission of carbon and D_α will also be reported.

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[1] M.R. Wade, *et al.*, *Controlled Fusion and Plasma Physics*, **20C** Part I, 283, 1996.
[2] R.D. Wood, *et al.*, *Controlled Fusion and Plasma Physics*, **20C** Part II, 763, 1996.