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Study of Carbon Transport in the Scrape-off Layer of HL-2A with Impurity Sources Located at Limiter, Baffle and Divertor

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Impurity transport in the scrape-off layer (SOL) has been studied for the ohmic heating plasma based on a space-resolved vacuum ultra-violet spectroscopy of which the intensity is absolutely calibrated with bremsstrahlung continuum in the HL-2A divertor tokamak. The radial profiles of carbon emissions of CIII (977 Å: 2s2 1S0-2s2p 1P1) and CIV (1548 Å: 2s 2S-2p 2P) as well as the ratio of CIV to CIII are used to investigate the edge impurity transport with relation to the source locations and the sputtering characteristics. The experimental results show that impurity profiles in the SOL have been clearly changed against different source locations: the profiles of CIV and CIII become flat for the dominant divertor source, but they become peaked for the dominant baffle source. Furthermore, in low electron density condition (ne < 2.6 x 1013 cm-3) the normalized intensities of CIV and CIII by the line-averaged electron density, CIV/ne and CIII/ne, decrease with the increase of density. The ratios of CIV to CIII increase with ne. On the other hand, in the moderate density conditions (ne > 2.6 x 1013 cm-3) the values of CIV/ne and CIII/ne become saturated. The ratios of CIV to CIII gradually decrease with density. The observations have been analyzed with the EMC3-EIRENE simulation code. The calculated profiles are fairly in a good agreement with the observations, i.e., peaked profile for the baffle source and flat profile for the divertor source. The reason why the impurity profile is sensitive to the configuration is due to the screening efficiency depending on the source location. An enhanced physical sputtering is also suggested by the simulations to explain the observations on the electron density dependence of the carbon ions transport in the SOL region.

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