Observation of edge impurity screening in L- and H‐mode discharges with additional ECH and NBI heating of HL‐2A


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Edge impurity transport in toroidal devices is of great concern for the control of the impurity concentration and the mitigation of the excessive divertor heat load, which mainly depends on the edge magnetic field structure in addition to the edge temperature and density. Deeper understanding on the edge impurity behaviors is desired in both fields of the experiment and theory, in particular, to establish the basis applicable to reactor-size plasma such as ITER. Active control of the core impurity profile has been reported in different heating scenarios of electron- and ion-heating regimes[1,2]. Several experiments indicated that the discharge operation in the electron-heating regime could decontaminate the impurities from the plasma core more efficiently than that in the ion-heating regime. However, the edge impurity behaviors have been seldom reported related to such different heating scenarios. In the present paper the edge impurity transport has been investigated based on carbon emissions of CIII (977Å: 2s21S0–2s2p1P1), CIV (1548Å: 2s2S–2p2P) and CV (2271Å: 1s2s3S–1s2p3P) measured with space‐resolved VUV spectroscopy [3] during the electron heating via electron cyclotron resonance heating (ECRH) and the ion heating via neutral beam (NB) heating in the HL‐2A tokamak (R = 165cm and a = 40cm). The discharges are mainly operated at high toroidal magnetic field of Bt = 2.4T with plasma current of Ip = 200-450kA under the presence of single-null closed divertor configuration.