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EX/P5-02: Effect of Lithium Coating on Edge Particle Recycling in EAST H-mode Discharge

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During the last EAST campaign, the lithium coating on the graphite plasma facing components (PFC) became a routine wall conditioning technique, which was applied by evaporation assisted by helium or deuterium glow-discharge cleaning (GDC) or ion cyclotron radio frequency (ICRF), and real-time lithium powder injection. Two ovens were used to thermally evaporate nearly 1 kg of lithium in EAST over a significant fraction of the PFC, and about 40g lithium powder were injected into the plasma by a lithium dropper. From the late-mid period of this campaign, the lithium evaporation was performed everyday with amount of about 13g. With progressively increasing lithium coating, the gas puffing rate was gradually increased because of the strong pumping capacity of the lithium coating. As a result, the ratio of hydrogen to deuterium concentrations H/(D+H) was gradually reduced approximately from 40% to 5% with deuterium gas fuelling until the amount of deposited lithium accumulated to 50g, which greatly improved the ICRF heating efficiency. Note that the lowest hydrogen concentration achieved previously without lithium coating was about 15% in helium discharges.

An absolutely calibrated photodiode array (PDA) with Dα filter viewing the lower divertor was used to investigate the neutral particle flux profile and estimate the neutral density. It was found that just prior to the L-H transition and during the H mode, the recycling peaked at the strike point, which showed that the neutral particle recycling predominately arose from the ion flux at the divertor plate. With increasing lithium accumulation, the neutral deuterium density near the lower X-point was reduced by a factor of 4 (from ˜20×10ˆ16 mˆ-3 to ˜5×10ˆ16 mˆ-3), and this was correlated with a gradual reduction in the low hybrid wave (LHW) heating power needed to access the H mode, i.e. down to ˜0.4MW for the shots with only LHW as auxiliary heating. It appears, hence, that the neutral particle density near the lower X-point might play a key role on the L-H transition. It is postulated that wall conditioning may affect confinement, e.g., via neutral-ion charge-exchange momentum losses, which may affact radial electric field and turbulent transport. The effect of lithium coating on edge recycling (such as by forming LiD) and its impact on plasma confinement will be further investigated in the future.

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