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EX/P6-21: Investigations of LHW-plasma Coupling and Current Drive in H-mode Experiments in EAST

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Aimed at high confinement (H-mode) plasma in EAST, the LHW-plasma coupling and current drive experiments were continued since last IAEA conference, by optimizing the plasma configuration and the distance between plasma and LHW antenna. A local gas puffing pipe near LHW antenna is installed to improve LHW-plasma coupling so as to sustain H-mode plasma. In the H-mode experiment without gas puffing shows that plasma-wave coupling deteriorates as the transition from low to high (L-H) confinement occurs, due to the steep gradient density profile in H-mode, which lowers the density at the grill mouth. The density is then recovered slowly until the H-L transition occurs. The plasma radiation has a correspondingly periodic characteristic behaviour during L-H and H-L transition. Such multiple L-H-L transition is mainly due to the changes of radiation power and coupled LHW power, suggesting that the coupled LHW power for H-mode plasma is marginal.
Using lithum coating and gas puffing near LHW antenna, an example of H-mode plasma up to 3.5 is sustained by LHCD alone. It is seen that there is no obvious change in RC from L-H phase due to gas puffing and coupling deteriorates after switching off gas puffing, thus leading to H-L transition. H-mode plasma is obtained by LHCD with a wide range of parameters: Ip=0.4˜0.8MA, Bt=1.35˜1.81T, ne=1.5˜2.5x1019 m-3, PLHW>=0.5MW. LHW power deposition and driven current profile with C3PO/LUKE are calculated with the experimental parameters. Simulation shows that the H-mode can be obtained in a wide range of power deposition, implying that central and large driven current seems not a necessary condition for the H-mode plasma. For typical H-mode discharge, particularly the power can not propagate into the core region due to high density during the H-mode phase. As a result, driven current decreases and loop voltage increases. This can be also seen from driven current profile predicted by the CRONOS, from which H-mode is reproduced with the initial equilibrium from EFIT and density from experiments. Floating potential measured by reciprocating Langmiur probe suggests that edge fluctuation is suppressed after L-H transition. This is possibly due to that LHW drives poloidal flow which can suppress fluctuation effectively. Though the CRONOS results are preliminary, it offers an effective tool to guide and interpret experiment for EAST.

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