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Lower hybrid current drive studies towards long-pulse plasma with high performance in EAST

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Aiming at a fusion reactor with lower hybrid current drive (LHCD), effective wave-plasma coupling and current drive at high density must be solved for LHCD. Related studies have been continued in EAST recently.

The wave-plasma coupling experiments [1] were studied with local gas puffing near the LH antenna, suggesting that gas puffing from the electron side is more effective to improve LH wave-plasma coupling. Furthermore, the gas puffing feed-back controlled by the reflection coefficient of LH wave was first demonstrated, suggesting the possibility of its application for long pulse plasma. In addition, LHCD experiments with high density were also investigated with different wall conditions (strong vs poor lithiation) and LH frequencies (2.45GHz vs 4.6GHz)[2-5]. Results suggest that lower wall recycling and higher LH frequency are preferred for LHCD at high density, mainly ascribed to parasitic effects of edge plasma. The linkage between plasma current profile modification in edge region by LHCD and LH frequency is observed for the first time, consistent with the parametric instability (PI) measurement and modeling, and the divertor footprints indicating different strike-point splitting behaviours [6]. Results suggest the PI effect on power dissipation in the edge region and its role on plasma current profile by LHCD. Experiments of effect of LH spectrum and density on plasma current profile were studied, demonstrating the possibility of profile control by adjusting LH spectrum and plasma density for high performance [1, 7]. Repeatable H-mode plasma is obtained by LHCD and the maximum density during the H-mode with the combination of 2.45GHz and 4.6GHz LH wave is up to $4.5\times10^{19}m^{-3}$. By means of LHCD, ECRH, and ion cyclotron resonance heating (ICRH), fully non-inductive RF dominant H-mode discharges with Vloop~0V over 100s have been achieved [8].

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