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EX/P5-15: Approaches towards Steady-State Advanced Divertor Operations on EAST by Active Control of Plasma-Wall Interactions

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EAST will be one of the world's first magnetic confinement devices that must address Plasma–Wall Interaction (PWI) issues facing high power steady-state operations. EAST has recently significantly augmented its RF heating capabilities up to 10 MW, including LHCD and ICRH. It has also undertaken an extensive upgrade during the recent shutdown to replace the carbon tiles on the main chamber wall and divertor surface by the Mo tiles, except those near the strike points, allowing baking up to 250 ℃, with active water cooling. The divertor titles will further be upgraded to monoblock Tungsten, as to be used in ITER, to address PWI issues for ITER and DEMO.
EAST demonstrated long pulse operation over 100 s, entirely driven by LHCD during the last experimental campaign. In order to achieve this, the following major means were applied to EAST to actively control PWI interactions: (1) Active divertor pumping using an in-vessel large capacity cryopump for facilitating density control; (2) Advanced wall conditioning with Lithium (Li) evaporation and real-time, in-situ Li powder injection for controlling neutral recycling; (3) Localized divertor gas puffing for reducing peak heat fluxes near the strike points, and (4) Strike point sweeping to spread the heat loads on the divertor target plates. In addition, highly radiative impurity Ar was injected into the divertor to further reduce the peak divertor heat fluxes and mitigate the in-out divertor plasma asymmetries in EAST. Despite the injection of Ar, Z_eff in the core plasma was little affected, suggesting strong divertor screening. Ar seeding has also been explored in the newly achieved H-modes in EAST, significantly increasing the frequency and decreasing the amplitude of ELMs, thus reducing the particle and heat loads on the divertor target plates. These first results are very promising, and will further be investigated in EAST for high power, long pulse operations.
EAST has now just started a new experimental campaign with significantly augmented auxiliary heating power and new Mo wall, which will lead to increasing PWI challenges. It will therefore require developing advanced scenarios for divertor heat flux control at high performance in a high-Z metal wall and long pulse operation environment. New advances and issues that may arise will also be presented.

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