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Present status of plasma-surface interaction investigations for EAST and CFETR

Zhongshi Yang, Guang-nan Luo and Jiangang Li

Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, 230031 China

Email address of corresponding author: zsyang@ipp.ac.cn

The Experimental Advanced Superconducting Tokamak (EAST) is the world's first fully superconducting magnetic confinement facility with ITER-like magnetic field configurations and heating schemes. Before 2014 EAST campaign, the upper divertor of EAST has been upgraded with W/Cu PFCs, with ITER-like W monoblocks for the divertor targets for heat fluxes up to 10MW.m−2, flat type W/Cu PFCs for the divertor dome and baffles for lower heat loads of 4~5MW.m−2. The Materials and Plasma Evaluation System (MAPES) project, which is located at the midplane outboard H port of EAST, aims to provide a comprehensive and flexible experiment platform for Plasma-Materials Interactions (PMI) research and the test of big engineering components in real tokamak environments. During 2014 campaign, several PMI diagnostics have been installed to observe PMI processes at the MAPES samples. A Langmuir probe array embedded in samples and a dedicated optical emission spectroscopy system provide information on local background plasma and impurity. The temperature profile on the sample surface can be monitored by infrared camera at M sector and embedded thermocouples. The CCD camera at D mid-plane port can be used to observe the exposure processes on the sample surface in real time.

To promote the development of the fusion energy for ultimate use in China, design activities of the Chinese Fusion Engineering Test Reactor (CFETR) have commenced. CFETR will be an important facility to bridge from ITER to DEMO, which is a necessary step toward the fusion power plant. The main objectives of CFETR are steady-state operation, full cycle of fusion power and T fuel. It relies on the existing ITER physical and technical bases and will be complementary to ITER. Due to the moderate fusion power (~200MW) production in the first phase, similar technical approaches for EAST will be used in the first operational phase of CFETR. Full W-PFCs with an ITER-like divertor configuration could be used in the first phase. New concepts and technologies will be required in the second phase with an expected fusion power of up to 1GW. Therefore, advanced divertor configurations such as snowflake and super-x are alternative concepts and experiments with snowflake divertor operations on EAST are foreseen.