Contribution ID: **612** Type: **Poster**

Novel Testbed Facility for PSI Issues in Fusion Reactor Conditions on the Base of Next Generation QSPA Plasma Accelerator

Thursday, 20 October 2016 08:30 (4 hours)

Understanding of plasma-surface interaction (PSI) effects during the transient events (disruptions, VDEs, ELMs) in tokamak reactor requires dedicated R&D activity in plasma simulators used in close connection with material characterization facilities as well as with theory and modeling activities. For such investigations different simulators of transient loads are now involved (quasistationary plasma accelerators QSPA, e-beams, pulsed plasma guns and, recently, PSI device), that are cost effective, flexible, able to provide faster results and important comparison of damage features from various machines.
In this report concept of new generation QSPA with external B-field up to 2 T has been developed and novel tesbed facility has been constructed. It allows new level of plasma stream parameters and its wide variation in new QSPA-M device, as well as possible combination of steady state and pulsed plasma loads to the materials during the exposures.
First plasma is recently obtained. Careful optimization of the operational regimes of the plasma accelerator's functional components and plasma dynamics in the magnetic system of QSPA-M device has been performed approaching step by step the necessary level of plasma parameters and their effective variation. The relevant results on plasma stream characterization are presented. Energy density distributions in plasma stream have been measured with calorimetry. Spectroscopy and probe technique have been also applied for plasma parameters measurements. The obtained results demonstrate ability of QSPA-M to reproduce the ELM impacts in fusion reactor both in term of heat load and particle flux to the surface. First results on plasma interaction with tungsten samples in QSPA-M are discussed.

Paper Number

MPT/P5-32

Country or International Organization

Ukraine

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Session Classification: Poster 5

Track Classification: MPT - Materials Physics and Technology