IAEA FEC 2014

Contribution ID: **20** Type: **Poster**

New In-Situ Measurements for Plasma Material Interaction Studies in Alcator C-Mod

Thursday 16 October 2014 14:00 (4h 45m)

Accelerator-based In-situ Material Surveillance (AIMS) is a novel technique for providing in-situ 2-D maps of the properties of plasma-facing surfaces in fusion devices, and has been successfully prototyped on the Alcator C-Mod tokamak [1]. AIMS adapts ion-beam analysis, the leading ex-situ material diagnostic tool, to the tokamak environment in order to provide quantitative non-destructive probing of surface properties. A high-current compact accelerator injects an ~MeV deuteron ion beam into the tokamak in-between discharges. The beam is magnetically steered, toroidally and poloidally, to different plasma-facing surfaces by steady-state low magnitude tokamak B fields. The deuterons induce nuclear reactions in surface isotopes producing ~MeV penetrating gammas and neutrons. Measured gamma and neutron spectra are interpreted to provide quantitative assessment of the surface isotopes. Thus, AIMS provides, for the first time, 2-D mapping of surface quantities that are time-resolved during plasma operations. The first AIMS experiments on Alcator C-Mod have studied boron film thickness and deuterium retention. AIMS provides good quantitative agreement with ex-situ analysis of boron thickness taken after the C-Mod campaign. Boronization has a clear effect on increasing the boron at the inner divertor but much less at the center-post location, likely due to outboard radial transport caused by ExB drift away from the EC resonance during boronization. The deuterium retention is strongly affected by the boron layer formation, but much less by plasma-cleaning techniques. Near the inner midplane, the boron deposits ~200 nm in 18 I-mode LSN diverted shots, and then becomes a location of net erosion for the following inner-wall limited shots. The measured high boron net erosion/deposition rates, combined with their complex temporal and spatial evolution, indicate the necessity for in-situ surface measurements such as AIMS.

Country or International Organisation

USA

Paper Number

EX/P6-21

Author: Dr WHYTE, Dennis (MIT Plasma Science & Fusion Center)

Co-authors: Mr SORBOM, Brandon (MIT Plasma Science & Fusion Center); Mr TERRY, David (MIT Plasma Science & Fusion Center); Dr BARNARD, Harold (MIT Plasma Science & Fusion Center); Mr STAHLE, Peter (MIT Plasma Science & Fusion Center); Dr LANZA, Richard (MIT); Dr HARTWIG, Zachary (MIT Plasma Science & Fusion Center)

Presenter: Dr WHYTE, Dennis (MIT Plasma Science & Fusion Center)

Session Classification: Poster 6