Contribution ID: **453** Type: **not specified**

P4.117 The influence of nitrogen on the deuterium retention within tungsten coatings for fusion applications

Thursday, 20 September 2018 11:00 (2 hours)

Plasma facing components (PFC) within a fusion device are subjected to a harsh operating environment such as high heat fluxes and exposure to high flux of hydrogen isotopes. This exposure can lead to a high fuel retention that can raise serious concern from safety point of view. One of the reason for the use of W as a material for construction of the first wall is aimed to reduce the fuel retention compared to carbon wall.
Nitrogen seeding, used in the operation of fusion equipment, represents a method to cool the divertor plasma and to reduce the W source in the divertor during inter ELMs. The effects of light impurity seeding have been analyzed so far mainly with focus on plasma heat transport and energy confinement and less on the plasma-wall interaction. However an exposure of the PFC to a combination of hydrogen isotopes and nitrogen can lead to changes in properties of exposed surfaces or to unexpected material behavior.
In the present work the influence of nitrogen on deuterium retention into the W coatings produced by high power impulse magnetron sputtering (HIPIMS) has been investigated.
NRA (Nuclear Reaction Analysis), XRD (X-Ray Diffraction) measurements, XPS (X-ray Photoelectron Spectroscopy) and SEM (Scanning Electron Microscopy) investigations were used for assessment of the chemical composition, fuel retention and the structure of the coatings. The elemental depth profile has been evaluated by using GDOES (Glow Discharge Optical Emission Spectrometry) measurement. A deuterium content up to 16 at.% has been obtained within the W coatings containing 30 at.% of nitrogen. It has been noticed that the N addition leads to an increase of the deuterium content within the coatings compared with W coatings obtained just in deuterium environment.

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Session Classification: P4