



Micro-distribution of fuel and metal in carbon based plasma facing materials



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Introduction

- Detailed knowledge of fuel retention in present-day tokamaks is crucial for the prediction of tritium inventory in a reactor-class device with D-T fuel.
- Surface retention of deuterium and metals was examined in Tore Supra N11 (SNECMA) tiles of the Toroidal Pump

Results





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Limiter (TPL) within the DITS Project [1]

• **The aim** was to determine the variations in the content and distribution of fuel and metal species.

Experimental



Ion Beam Analysis

Collimator Magnetic quadrupole lenses Target chamber



Shadowed region: random metal distribution





Flaking region : Areas with high metal concentration have lower **D** concentration but there is exceptions





NRA: 100 mSr 1500 µm detectors **PIXE SI(Li) detector 30mm² 6mm thick** FAST MPA-3 data collection SIMNRA data analysis [1]

Results



Micro beam in the **Tandemlab of Uppsala University**

SEM images

showing the

the ranges of

concentration

found over the

surface with a mm

beam for all four

investigated. Also

deuterium

samples

shown is the

position on the

TPL and the local

plasma conditions.

morphology and

Thin layer: Areas with both high metal and deuterium concentration





Erosion zone: Metal and deuterium are found together probably in pits that are protected from the plasma erosion

Besides the stainless steel components found on all surfaces Ti was also found in the thin layer. Ti was used to join the CFC with the copper heat sink[3]

Summary and Conclussions

 Simultaneous mapping of deuterium and metals has been performed

• The stain less steel components Fe Cr and Ni appear together

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> **Results of EDX measurements in three different spots of** the flaking region of the TPL. The stainless steel components are deposited together.

References and further reading

[1] E. Tsitrone et al., Nucl. Fusion 49 (2009) 075011 [2] M. Mayer, Am. Inst. Phys. Conf. Proc. 475 (1999) 541 [3] P. Pelicon, NIM-B (2011) doi:10.1016/j.nimb.2011.02.049 • Other metals (Ti) can have other patterns

 There are relations between the metal deuterium concentration that and are dependent on plasma condition