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Marker Tiles at JET with ITER-Like Wall



Beryllium Inner Wall Guard Limiters Messages:



Research Team

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Erosion-Deposition Diagnostics in JET-ILW: les and Probes



Main Chamber: LIMITERS

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Message: Very thick deposits seen in JET-C are not formed in ILW (2011-2012) AEA TM47136L

Mirrors in JET-ILW: Reflectivity Change



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Composition and Structure of Deposits

Operation in the divertor: 13.1 h



Messages:

· Co-deposits contain a mix of *Be* with *D* and small content of *W*, *O*, *N*, *C*

Not uniform deposition is related to the substrate structure.

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All optical systems in ITER will rely on metallic first mirrors.

A comprehensive test in JET is done on the request of the ITER Design Team (2002).

Three stages of the program:

1	2005 - 2007	
Ш	2008 – 2009	
Ш	2011 - 2012	JET-ILW

Test mirrors were retrieved during the major shutdowns.



- Polycrystalline Mo Rh-coated Mo
 - Location of mirror carriers: Main chamber wall



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Wall Probes: Mirrors in Inner Divertor \bigcirc **Heavy Ion ERDA** Inner Divertor (#69 Rh-coated) 1.00 r per nm layer, /cm2/nm -Rh -C te15 at/c 0.10 -Be -w Ni 0.01

Depth, nm The deposited layers are composed of Be, C, W, Inconel metals. Be is a dominant element in deposits.

Concentration of C dropped since the restart phase of JET-ILW.

75

100

125

150



25

- - Divertor: inner, outer, base Marek Rubel IAEA TM47136i Da





The deposited layers are composed of Be, C, W, Inconel metals. Be is a dominant element in deposits.

Concentration of C dropped since the restart phase of JET-ILW. High retention of N is observed as a result of impurity seeding.

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SUMMARY: ESSENTIAL

- Low deuterium inventory: •
 - below 5x1018 cm-2 - Absolute:
 - Be/D > 10 in thick deposits - Relative
- Thick deposits on the upper part of inner divertor: Tiles 0 & 1. •
- Deposition pattern agrees with modelling (K. Schmid, 2014)
- Thin deposits (< 0.3 $\mu m)$ in the divertor in ILW in comparison to very thick layers (100 $\mu m)$ in JET-C. •
- Low absolute amounts of carbon in deposits.
- Strongly reduced transport to shadowed areas: ٠
 - reduced/eliminated carbon source,
 - but ... W and Be detected on mirrors.
- Degradation of divertor mirrors need for replacement in ITER. ٠
- Retained total reflectivity of Mo mirrors in the main chamber periodic refreshment by Mo evaporation.

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Wall Probes: Main Chamber Wall **Heavy Ion ERDA** Outer wall



Atomic density per nm layer, 1e15 at/cm2/nm

Unit 3E, 3 cm (#94) Unit 4B, 3 cm (#99) 1 layer, 0.8 0,8 density per nm le15 at/cm2/nm 0,6 _c 0.6 0,4 04 0.2 0 2 Atomic 10 20 40 20 Depth 30 nm 50 Depth, nm

Thickness of the modified layer is approximately 20 – 30 nm. Mix of species in a thin surface layer.

Small quantities of Ni, Fe, W are detected by XPS.