

Overview of JET post-mortem results following the 2007-9 operational period, and comparisons with previous campaigns

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Introduction - Deposition in the JET divertor - ¹³C deposition following puffing experiments - Erosion at the IWGL - W-coating erosion in the divertor - Summary



Plasma facing Components: Erosion/Deposition (Global trends)



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9-13/5/2011

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Marker tiles 2004-9 or 2007-9



EFJET JET MkII-HD divertor cross-section

In use 2007 to present, and will be used for ILW

Plasma configuration as used for the ¹³C puffing experiment on last day before shutdown





Deposits in inner SOL

Tiles exposed 2007-9

Heavy deposition of C, Be and other impurities in inner SOL, chemical sputtering of C and transport to corner, resulting in enhanced Be/C ratios.

Values of Be/C in outer micron up to 4.5 – a record for JET!

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Updated comparison of Be/C on tile 6



14BW G6B 2004-2009





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-0.200



Tile profiling of divertor tile 6

Maximum deposition on tile of ~650 microns in 2005-9 compares with ~800 microns 1998-2007 (Likonen)

Position of peak thickness is not coincident with maximum Be/C

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More details: P15B Anna Widdowson



Transport at outer divertor corner

Positions of maxima

- A: Strike point frequency (magnetic) – 1415 mm
- B: Strike points (Dα) 1434 mm
- C: Thickest film (C+D) -1448 mm

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D: Be/C ratio -1480 mm



EFJET Bottom of outer carrier after 2007-9

Thick deposited films on/under diagnostics installed in 2007.

Note little deposition on end of tile 7





¹³C puffing on last day of JET 2009 operations

79816-79831 (10 good pulses)

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79832-79853 (20 good pulses)



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OSP during tracer injection (57-63s)



First profiles from RBS on tile 6 (SOL)



- Poloidal distribution at a toroidal position on two tile 6
- Strong local deposition close to injection location but also deposition far from the puffing hole
- Comparable deposition pattern in the sloping part of tile 6 at both toroidal positions (from re-eroded ¹³C)





Deposition on W-coated LBT



Plasma configuration for 13C puffing experiment

23rd Oct 2009

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Maximum ¹²C and ¹³C



Strike point on last day of operations in 2009?

More details: O-08 Jari Likonen

EFJET W coating on LB tile exposed 2007-9

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2007-9 tile W coating is

still intact everywhere, and no thinning was measurable by IBA – in contrast to the situation on IWGL tile 3X11L

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Peaks of ¹²C and ¹³C just inside PFR. Also ¹²C increases (and Be and D) towards outboard edge



NRA data for Be and D on pairs of IWGL tiles at the top, middle and bottom of the limiter

³He energy beam (2.5 MeV) D(³He,p)⁴He, ⁹Be(³He,p)¹¹B,







Erosion of IWGL tiles

9-13/5/201

7X12L exposed 2005-2007, coated with W and Re stripes

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3X11L exposed 2005-2009, coated with W along top edge



Conclusion is that the erosion of the IWGL near the mid-plane is due to start-up plasmas and not neutral beam shine-through

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Schematic views of IWGL tile 7Z12L (middle of limiter) showing the erosion and deposition zones, and their positions relative to the leading edge of the tile. Tile 3X11L is similar.

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Perspective View

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-0.100



3X11L (2004-2009)



Toroidal distance along tile (mm)

More details: P15B Anna Widdowson

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Experience with W-coated LB SRP tiles

LB SRP tile coated with ~10 µm W and exposed in JET 2007-2009

Maximum ¹²C and ¹³C



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Strike point on last day of operations in 2009?

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LB SRP tile coated with ~0.7 and 1.6 µm stripes W and exposed in JET 2005-2007



EFJET W coatings on LB tile exposed 2005-7

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Thinner W coating (0.7µm) has been eroded from plasma-facing areas and redeposited in areas shadowed by the roughness of the surface

Thicker coating (1.6 µm) is still covering all areas of the surface, though it is very thin at some points.

M Mayer, IPP Garching



- Marker tiles
 - 2 full poloidal sets of divertor tiles
 - Outer poloidal limiter tiles
 - Inner wall guard limiter tiles

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- Dump plate tiles
- Inner Wall Cladding tiles



9-13/5/201

First set of tiles will be removed in 2012 during short intervention

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- Progressive changes in deposition pattern on tile 6 have occurred since 2001 – greater Be/C on sloping part of tile, and more migration of C into shadowed corner of the divertor
- Little interaction of plasma with upper dump plate, and less interaction with the OPL since 1996-8
- Much stronger erosion at central part of IWGL than in the divertor (logical limiter versus divertor behaviour)
- Latest tiles provide another interesting ¹³C dataset to challenge modellers