UKAEA activities in 2023: TDS and microscopy analysis of JET PFCs – plans

Y. Zayachuk, A. Widdowson, I. Jepu, R. Kerr, P. Coad

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SP E.1 - Coordination activity

- Sample shipments:

  - Additional PFCs for SPE program
    - ✓ Divertor tile 2BNG4C (W620 54 301 1) 2010-2012 – to VTT for coring (metal work to be removed before sending)
    - ✓ W probe from lamellae cut samples no. 106, ILW3 - C2 standard sample – to IPPLM
    - ✓ Langmuir probes (removed 2015) – shipments TBC
      - 15IN probes 5; 6; 9- confirmed by photos (found in BeHF)
      - 16IN probes 5; 6; 7;8; 9 - confirmed by photos; photos of bags and probes holders only – TBC
      - 17IN probes 5; 7 - confirmed by photos
    - ✓ Louvre clips (ILW3)
    - ✓ 4B baffles and tubes (rotating collector and mirror assembly) - confirmed by photos

SP E.2: Comparison of hydrogenic retention quantification

- Baking cycle simulations.
- Study of the efficiency of baking for fuel removal:
  - ➢ W-CFC (HFGC + tile 1; ILW3 and ILW1-2) and Be samples (4D14, ILW3) → divertor and limiter covered.
  - ➢ Initial IBA (IST) or SIMS (VTT)
  - ➢ TDS – long baking (~60 hours) at a relevant temperature (350^{o}C for divertor, 240^{o}C for limiter).
  - ➢ Post-TDS IBA (IST) or SIMS (VTT).
  - ➢ Full temperature range TDS up to 1000^{o}C.

- Continuation and finalization of the work started in 2022.
  - ➢ Comparison of pre-TDS and post-TDS IBA → near surface efficiency.
  - ➢ Comparison of integrated release during baking and final TDS → bulk efficiency.
  - ➢ Time dependence of release rate during baking → power law(s) as function of the state of material.

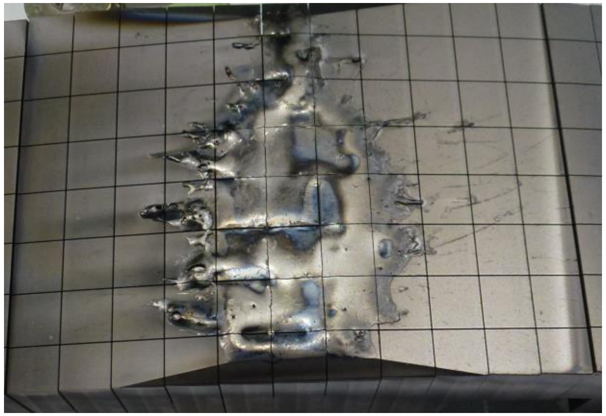
SP E.2: Comparison of hydrogenic retention quantification

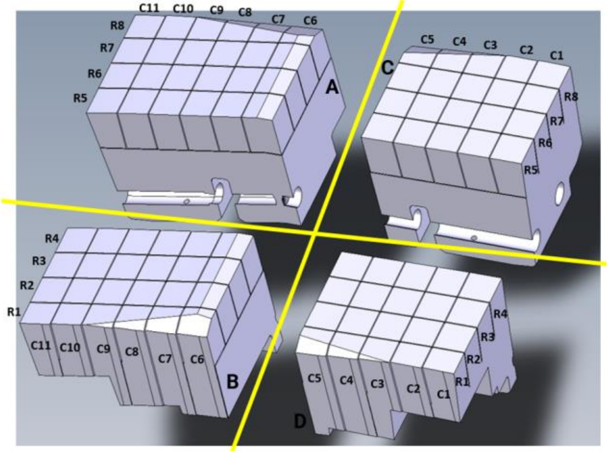
- Retention in molten Be.
  - Samples of tile 3A8 (ILW3).
  - TDS measurements.
  - Comparison with IBA, pre-TDS and post-TDS (IST).
  - Impact of melt damage on retention → comparison with undamaged Be.

- Retention in stack B bulk W divertor samples.
  - Tile 5, stack B lamellae (ILW3 and ILW1+3).
  - TDS measurements.
  - Toroidal and poloidal (comparing with stacks A, C and D, done previously) comparison of retention and desorption spectra.
  - Correlation with pulse data – fluence and temperature.

SP E.3: Post-mortem analysis of PFCs and other objects in JET

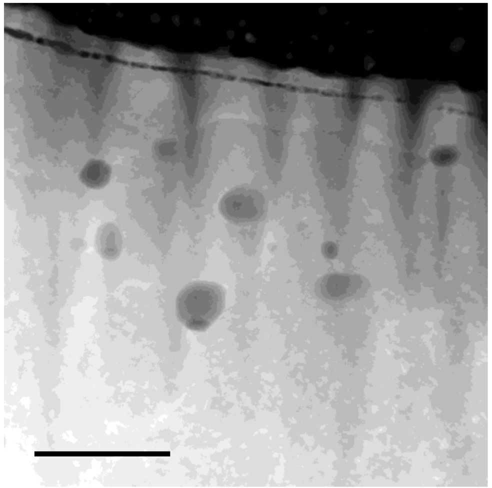
- Runaway electron damage studies:
  - ➢ IWGL tile 1XR18.
  - ➢ IBA analysis in poloidal, toroidal and “depth” direction (IST)
  - ➢ Metallography measurements (IAP).
  - ➢ Main pulse assessment responsible for this damage.

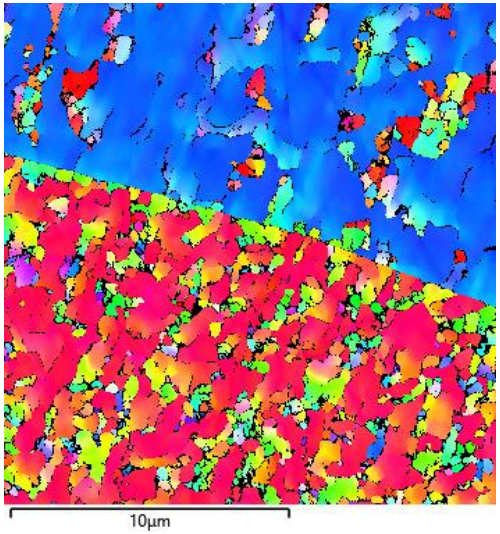




SP E.3: Post-mortem analysis of PFCs and other objects in JET

- Microscopy and microanalysis.
- Bulk W (tile 5) and Langmuir probes:
  - Stack C, ILW1 lamella.
  - Atom probe analysis → which impurities are segregating to grain boundaries and could be sublimating to produce voids.





  - Study the strain within the substructure using high resolutions EBSD.
  - Replicate Langmuir probe microstructure (voids, grain growth and substructure) by heat treating an as received Langmuir probe.