**PLASMA-SURFACE INTERACTIONS IN THE STELLARATOR W7-X: CONCLUSIONS DRAWN FROM OPERATION WITH GRAPHITE PLASMA-FACING COMPONENTS**


**Introduction to the Optimised Stellarator Wendelstein 7-X**

- Optimised stellarator design with 5-fold symmetry.
- Ionized loss, 2.8 A (plasma notes).
- Heating power: 5.8 MW (ECH), 3.4 MW (IBW).
- Plasma current: 3.6 MA, 5.6 MA (IBW).
- Toroidal mode: Q = 1.0.
- Inlet divertor for power and pellet exhaust and impurity screening.
- Divertor target plates follow the magnetic field geometry.

**Netto Erosion / Deposition Measurements at the Horizontal Target Plates**

- C and Mo erosion used as proxy for C and O impingement particle flux.
- Measurement techniques: ex-situ analysis (SEM, FIB, EDX), IBA, EBS, SIMS.

**3D Simulation of Material Migration in Standard Configuration with ERO2.0**

- Benchmark experiment with C transport and surface composition.
- Eroded material: fine grain graphite.
- Initial material: graphite.
- Secondary and tertiary material: Mo, graphite.
- Implanted angular source injection.
- Erosion and deposition in the divertor half modules.

**Erosion / Deposition Measurements Utilising Marker Divertor Target Elements**

- Measurement techniques: x-ray emission spectroscopy via SEM, FIB, EDX.
- Ex-situ information.
- In situ information.

**Impact of Boronisation on W7-X Operation in OP B**

- Reduced C erosion after boronisation.
- Boronisation reduces the impurity production by oxygen/C ions on graphite.
- Benchmark experiment about C transport.
-ENCH: EMC3-EIRENE plasma background which matches plasma conditions and heat flux.

**Erosion / Deposition Measurements at the Vertical Target Plates**

- Impingement particle flux (H m s^-1).
- Normalised impurity flux (H m s^-1).

**Conclusion for Long-Pulse Operation in W7-X**

- Plasma operation with the upgraded source and divertor showed similar results compared to the operational activity with PIN plasma sources in W7-X.
- Improved isotope retention of divertor divertor and improved divertor performance.
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**Plasma-Wall Interactions Processes**

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