WP PWIE SP B.2 & SP B.3: KICK-OFF MEETING,

M.Rasinski
Forschungszentrum Jülich GmbH, Institut für Energie- und Klimaforschung – Plasmaphysik,
52425 Jülich, Germany

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SP B / Experiments on erosion, deposition and material migration

SP B.2 Material migration in toroidal devices

- Coordinate erosion and migration experiments and related surface analyses on W7-X; perform surface analyses for erosion/deposition, fuel-retention, and surface-modification patterns (incl. melting patterns for SP A) on samples from AUG, WEST, and W7-X (FZJ).

D4 NRA, SEM, and FIB characterization of marker samples and coatings from selected plasma experiments on AUG, WEST, and W7-X with conclusions (FZJ)

SP B.3 Characterization of plasma-exposed materials

- Project coordination for W7-X analyses; Determine surface changes on selected WEST and W7-X wall tiles, reference coatings from plasma exposures in PSI-2, and from recrystallization studies under SP A in MAGNUM-PSI (FZJ)

D2 SEM, FIB, NRA, and LIBS characterization of selected WEST and W7-X wall tiles and plasma-exposed reference samples (FZJ)

Capabilities

IBA Measurements

- 1.4 MeV Tandetron
- projectiles: 4He, 3He, p, D
- „µ-beam“ setup: ~ 30 µm beam diameter
- dedicated high throughput chamber
- RBS, NRA, PIGE

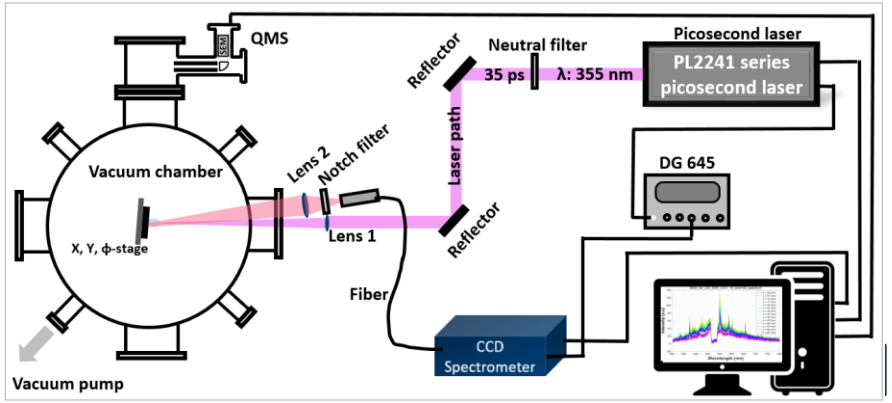
rotary sample holder µNRA

Surface morphology

- FIB/SEM surface and cross-section observation
- EDX and EBSD for chemical and crystallographic identification
- FIB machining – cross-sectioning, TEM lamella preparation
- STEM detector for transmission electron observations
- TEM microscopes for dedicated transmission electron studies (including EDX and EELS)

LIBS

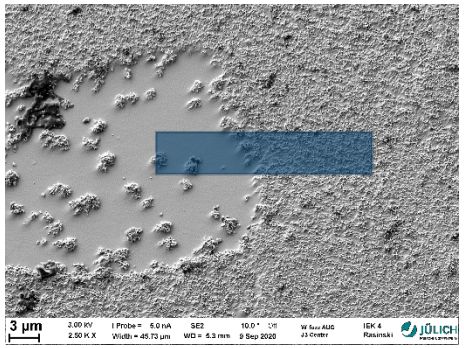
- ps-, ns- and dp-LIBS setup
- in-situ LIBS studies in PSI-2
- Study the composition and fuel retention in reference coatings and deposited layers from W7X

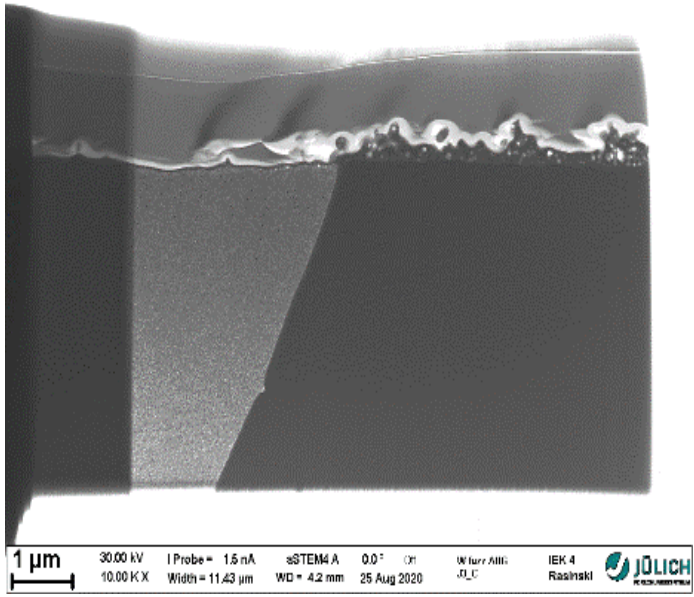


Schematic of the ps-LIBS setup

ASEDX Upgrade

Continue characterizing W samples with nanostructured and pre-damaged surfaces following their exposure to He plasma experiments on AUG





- Study the fuzz grown in the AUG, impact of pre-damage in PSI-2
- Study the inhomogeneous fuzz growth depending on the W grain orientation

Mo marker samples exposed to H-mode plasmas on AUG

- Check the morphology and composition of deposited layers
- Check the Re content in the deposited layers and particles (TEM, EDX)

W7-X

IBA

- 13C analysis of W7X TDU units after OP1.2B
- using 13C(D,p)14C reaction
- focus on tiles near the injection location

Surface morphology

- Detailed investigation of deposited layers on various W7X TDU after OP1.2B including study of the thickness and compsition (O, B)
- Cross-check with other techniques (LIBS) on selected locations

WEST

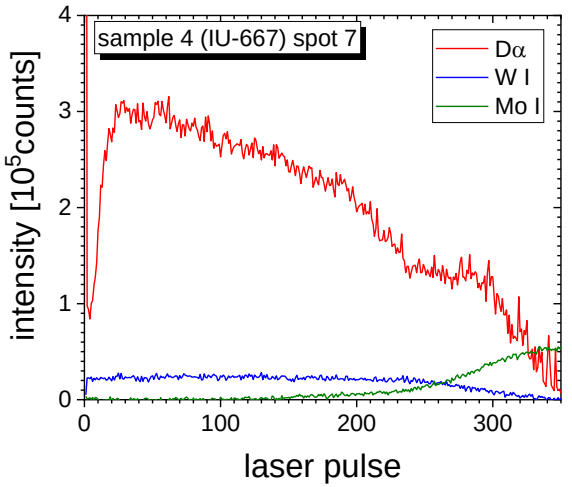
Selected marker tiles after C4 (currently at IPP Garching) WEST campaign for:

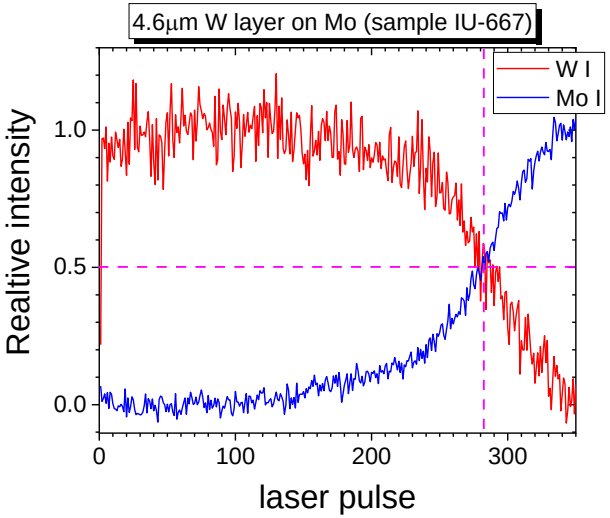
- Erossion and re-depositin, surface morphology and composition studies.
- Comparison of tiles after C1-C4 and C4 only campaign

LIBS on reference coatings

ps-LIBS on Mo samples with different W coatings

- Various W coating (dense, porous, WTa, WO) on Mo substrates exposed to D and He plasma in PSI-2
- Surfece morpholody and composition before and after PSI-2 expsoures
- Fuel retention investigation in exposed coatings





MAGNUM-PSI

- Investigate the impact of the nature of loading (e-beam vs plasma beam) on the recrystallization on two different grades of tungsten.
- Steady state loading at JUDITH / Magnum-PSI at constant temperature, but different time of exposure for each block.
- H plasma, floating conditions, T_{base} ~2100 C
- **At FZJ – profilometry, harndess, SEM with EBSD**