WP PWIE SPA3 (2021): KIPT
D004: Investigation of advanced materials under ELM-like/ disruption transient loading and subsequent analysis

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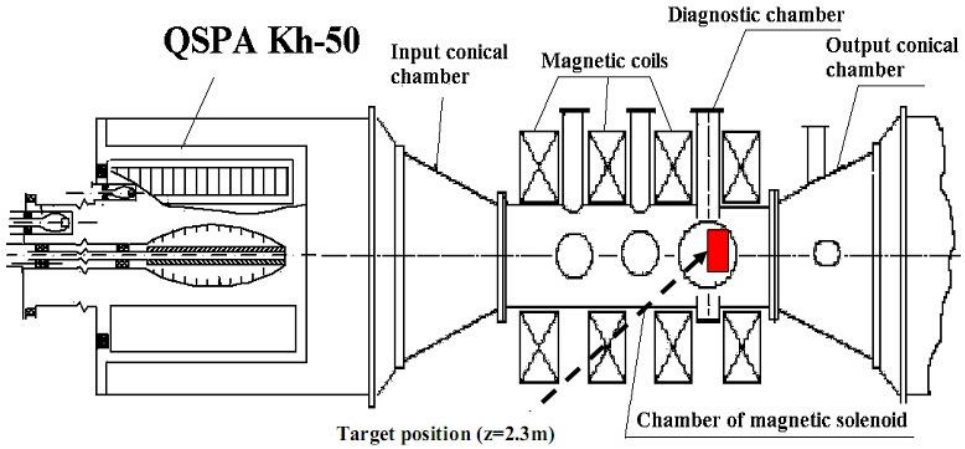
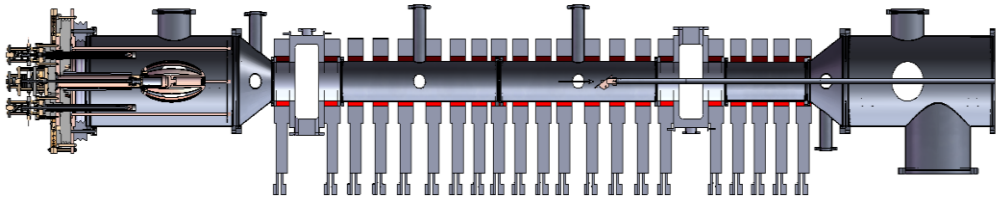
Experimental facilities: QSPA Kh-50; QSPA-M



Plasma energy density	0.1–2.2 MJ/m^2
Plasma load duration	0.25 ms
Diameter of plasma stream	15 cm

V A Makhlai et al *2020 Phys. Scr. T171, 014047*

QSPA-M



Plasma energy density	0.1-1 MJ/m^2
Plasma load duration	0.1 ms
External magnetic field	0.8 T
Diameter of plasma stream	6 cm

Diagnostics

- ❖Calorimetry
- ❖Optical emission spectroscopy
- ❖High-speed digital camera PCO AG

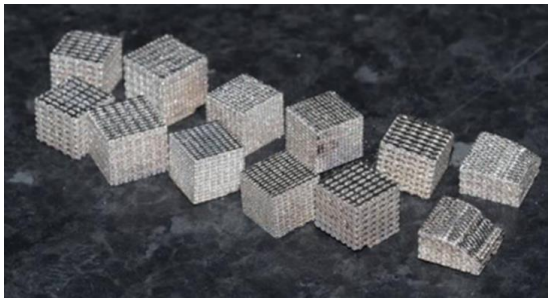
I.E. Garkusha et al 2017 Nucl. Fusion 57, 116011;
I.E. Garkusha et al 2019 Nucl. Fusion 59, 086023

Tasks of KIPT from PEP to be performed in 2021/2022

- Plasma qualification of new materials (WPMAT) and components (WP DIV) for DEMO: Thermal shock and plasma synergistic loading of advanced material including exposures in Magnum-PSI (KIPT, DIFFER, FZJ)
- Exposure in plasma devices to study the interplay of recovery, recrystallization, plasma and ELM-like loading on surface cracking and fatigue lifetime (FZJ, KIPT, DIFFER)

Latticing AM W/WTa samples (WP DIV) exposed within QSPA Kh-50 in 2020

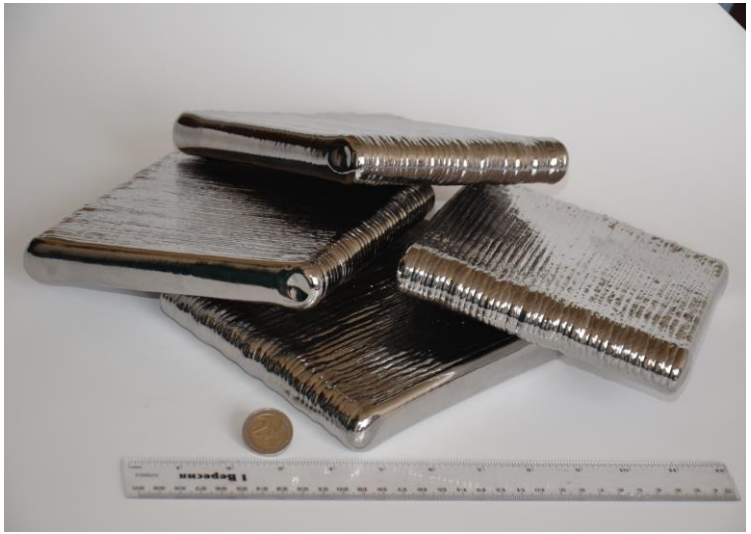
	Sample origin
Lattice W Ta L6 Not polished	CCFEx4
	CCFEx4
	CCFEx4
Lattice W Ta L6 Polished	CCFEx4
	CCFEx4
	CCFEx4
Lattice W L6 Polished	IPPx4
Solid W Not polished	IPPx2, CCFEx2
	IPPx2, CCFEx2



- SEM images was received for all exposed samples
- Other Post-mortem analyses will be performed in CCFE (delay due to COVID influence)

Common paper was submitted to Nuclear Fusion as contribution of FEC 2020 (may 2021)

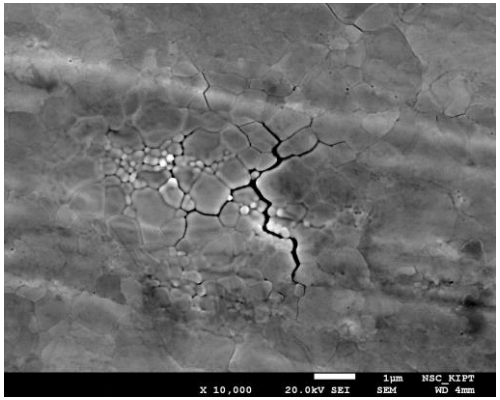
- Plasma qualification of new materials (WPMAT) and components (WP DIV) for DEMO: delay till delivered of samples
- The 12 polished samples of the IGP W material with transversal grain orientation were provided by Marius Wirtz as link between WP MAT at august 2021.



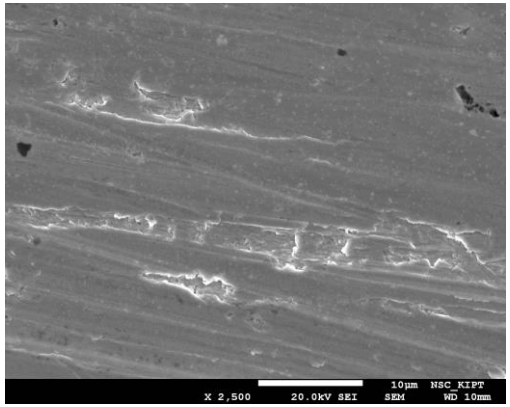
- Samples of large (up to 20×170 × 160 mm^3) profiled tungsten single crystals produced by meanse of plasma-induction growing technology at E.O. Paton Electric Welding Institute, Kyiv Ukraine were irradiated by 10 plasma pulses.
- Heat loads were were chosen below (0.45 MJ/m^2) and above (0.75 MJ/m^2) tungsten melting threshold.
- Base temperature was $T_{base} = 400°C$

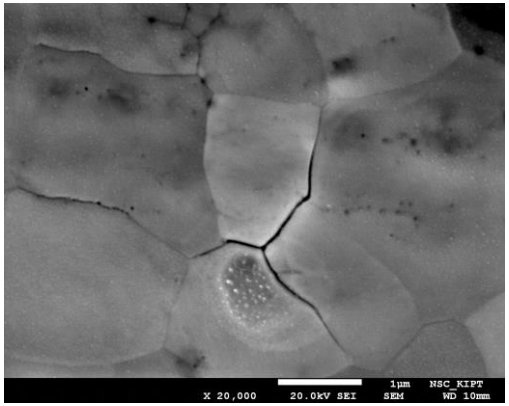
SEM images: samples before (left) and after (right) plasma irradiation

heat load below W melting threshold



heat load above W melting threshold





- Cracks, separation of particles are observed on the exposed surfaces