

PWIE-SPA 4-D002

Annealing of chosen tungsten-based materials and quantification of recrystallization kinetics

Wolfgang Pantleon

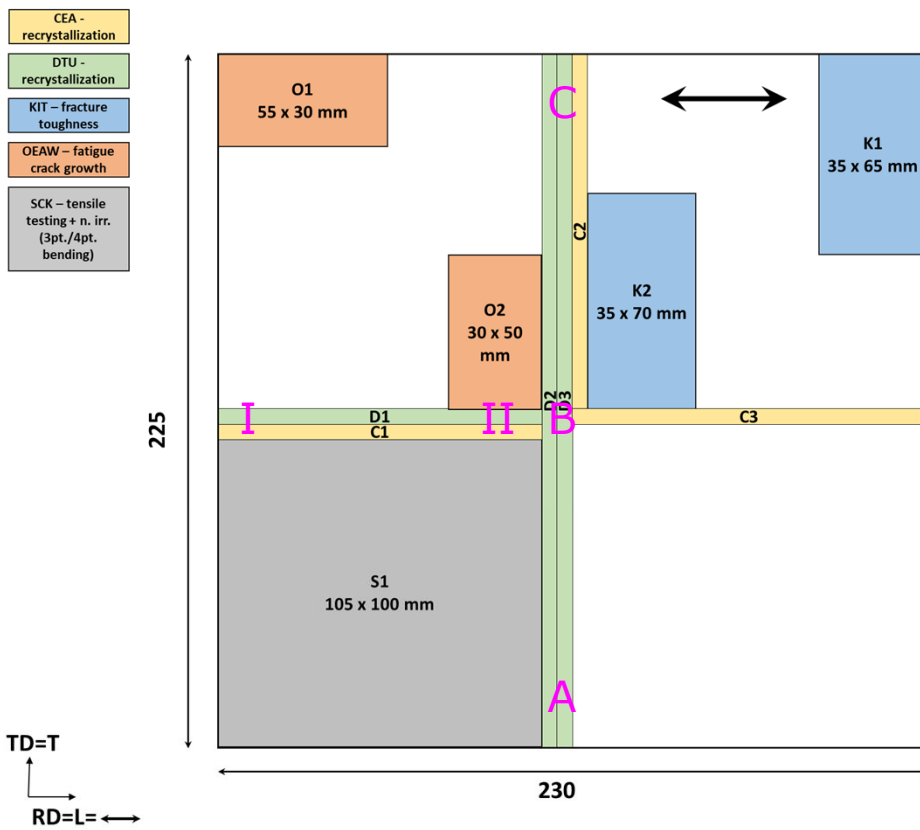
Task specification

- Tasks to be performed (in general 2021/2022)
Characterization of microstructural changes caused by plasma exposure. Tungsten-based material exposed to different plasma conditions will be investigated in terms of mechanical and microstructural depth profiles. Heterogeneities will be traced in hardness and orientation maps and the locally dominating restoration mechanism identified.
- Task 2021
Annealing of chosen tungsten-based materials and quantification of recrystallization kinetics

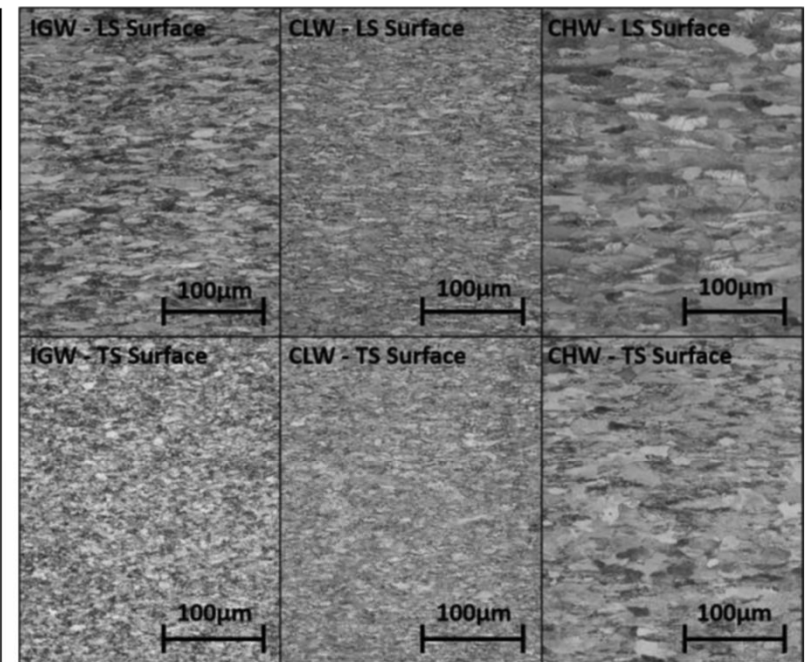
Base-line material: rolled tungsten plates form A.L.M.T. Corp., Japan

Differently rolled tungsten plates from A.L.M.T. Corp., Japan

- ITER, CLW, CHW



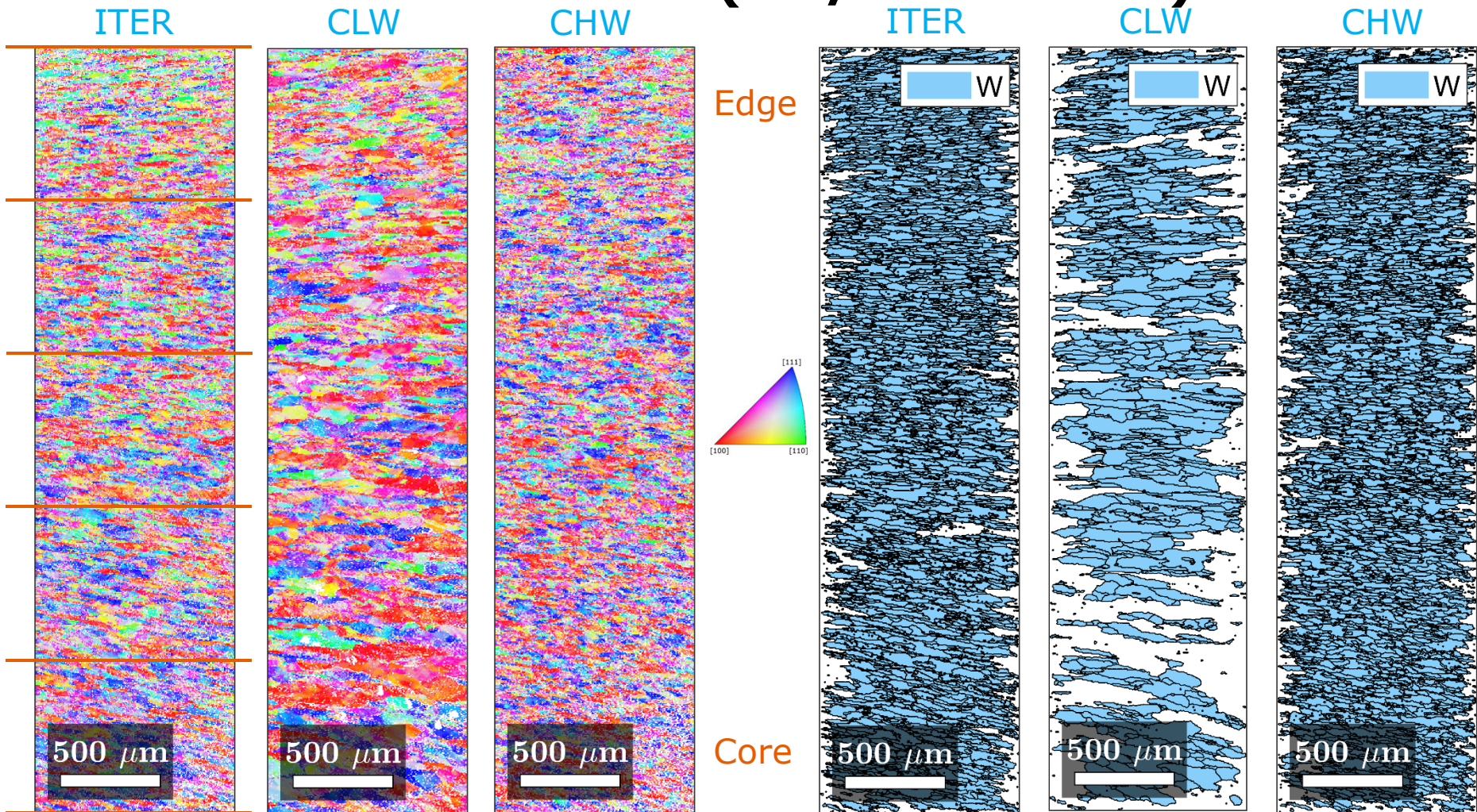
ID	IGW	CLW	CHW
Rolling Direction	L-Direction	L and T Cross	L and T Cross
Rolling Ratio	Normal	Normal	High



Yu et al. Fusion Engng. Des. 157 (2020) 111679

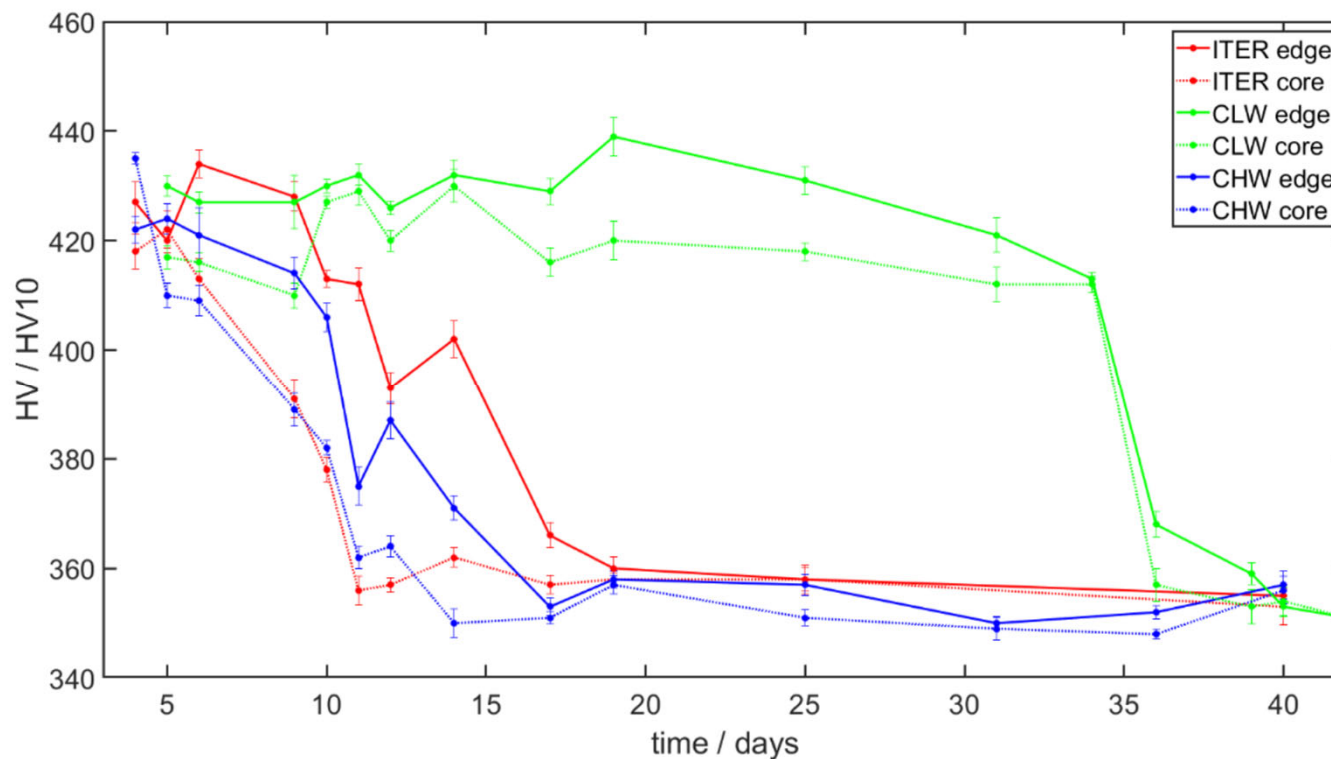
EBSD

As-received condition (RD/ND section)



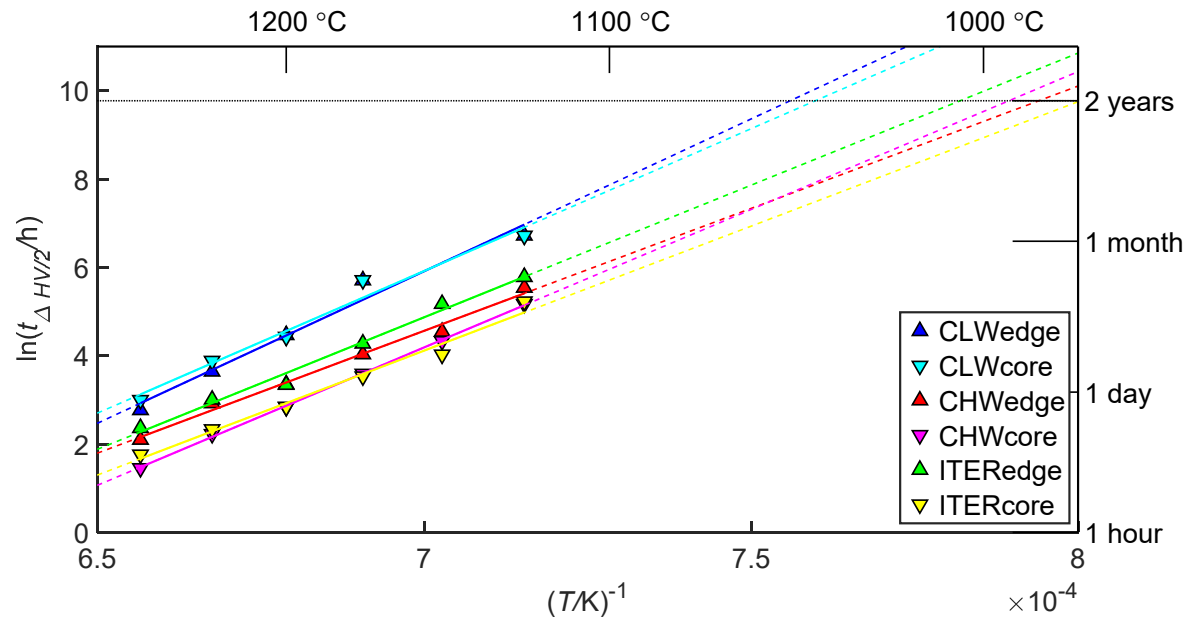
Differently rolled tungsten plates A.L.M.T. Annealing at different temperatures

- Hardness evolution at 1125 °C



Annealing temperatures
1125 °C
1150 °C
1175 °C
1200 °C
1225 °C
1250 °C

Differently rolled tungsten plates A.L.M.T. Annealing kinetics – Half hardness loss



- Activation energy and extrapolation to two years

	ITER Edge	ITER Core	CLW Edge	CLW Core	CHW Edge	CHW Core
Q / kJ/mol	497	468	572	536	497	519
T (2 y)	1005 °C	975 °C	1050 °C	1045 °C	985 °C	995 °C

Conclusion and outlook

- Characterization of tungsten-based material
- Present base-line material
- Differently rolled tungsten plates from A.L.M.T.
 - As-received condition analyzed quantitatively towards improved interpretation of rolling conditions
 - Annealing at additional temperatures performed, analysis to be completed
- Hardness map W80% warm-rolled tungsten

