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NCSRD: Results from WEST C3 marker PFUs - correspondence to MPG results

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DEMOKRITOS

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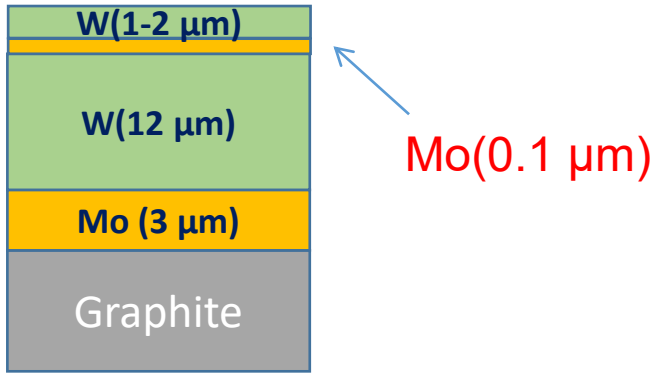
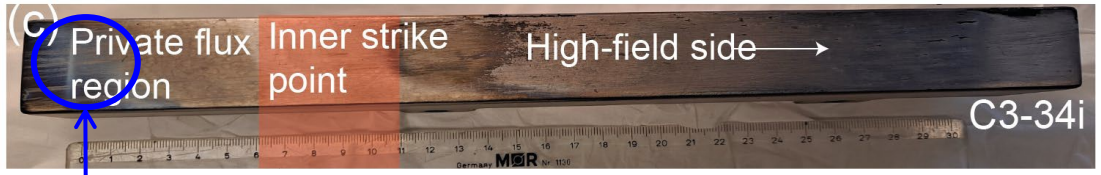
WEST C3 samples - Methodology

Samples : **C3-22oG** and **C3-34iQ**

Sample composition: Graphite/Mo(3 μm)/W(12 μm)/Mo(0.1 μm)/W(1-2 μm)



C3-22oG (S=125 mm)



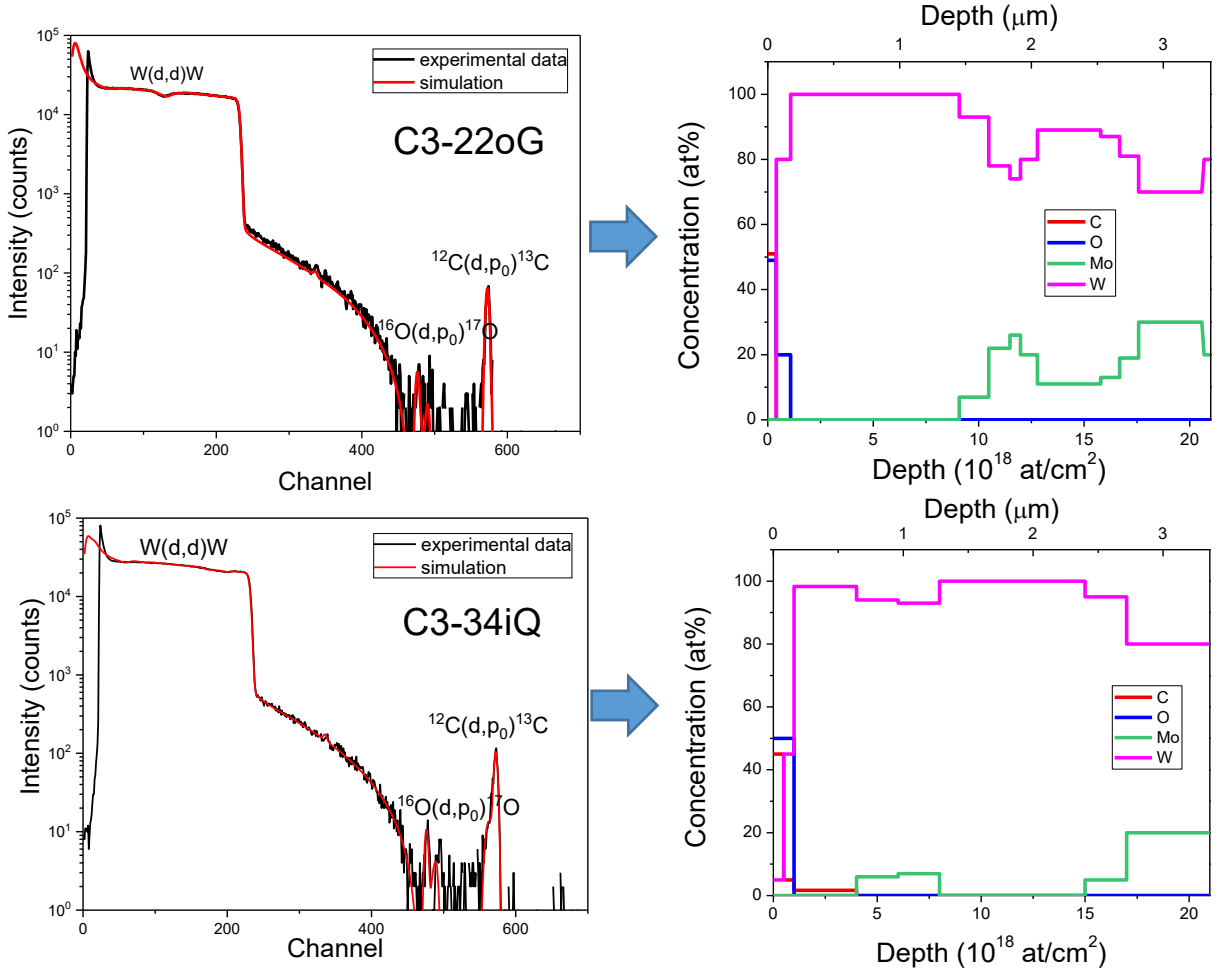
C3-34iQ (S=312.5 mm)

Methodology: RBS/NRA measurements using a deuteron beam (1.35 MeV, detection angle 170°), SEM/EDS, XRF

Aim: Investigation of surface erosion, material migration/deposition

RBS/NRA results

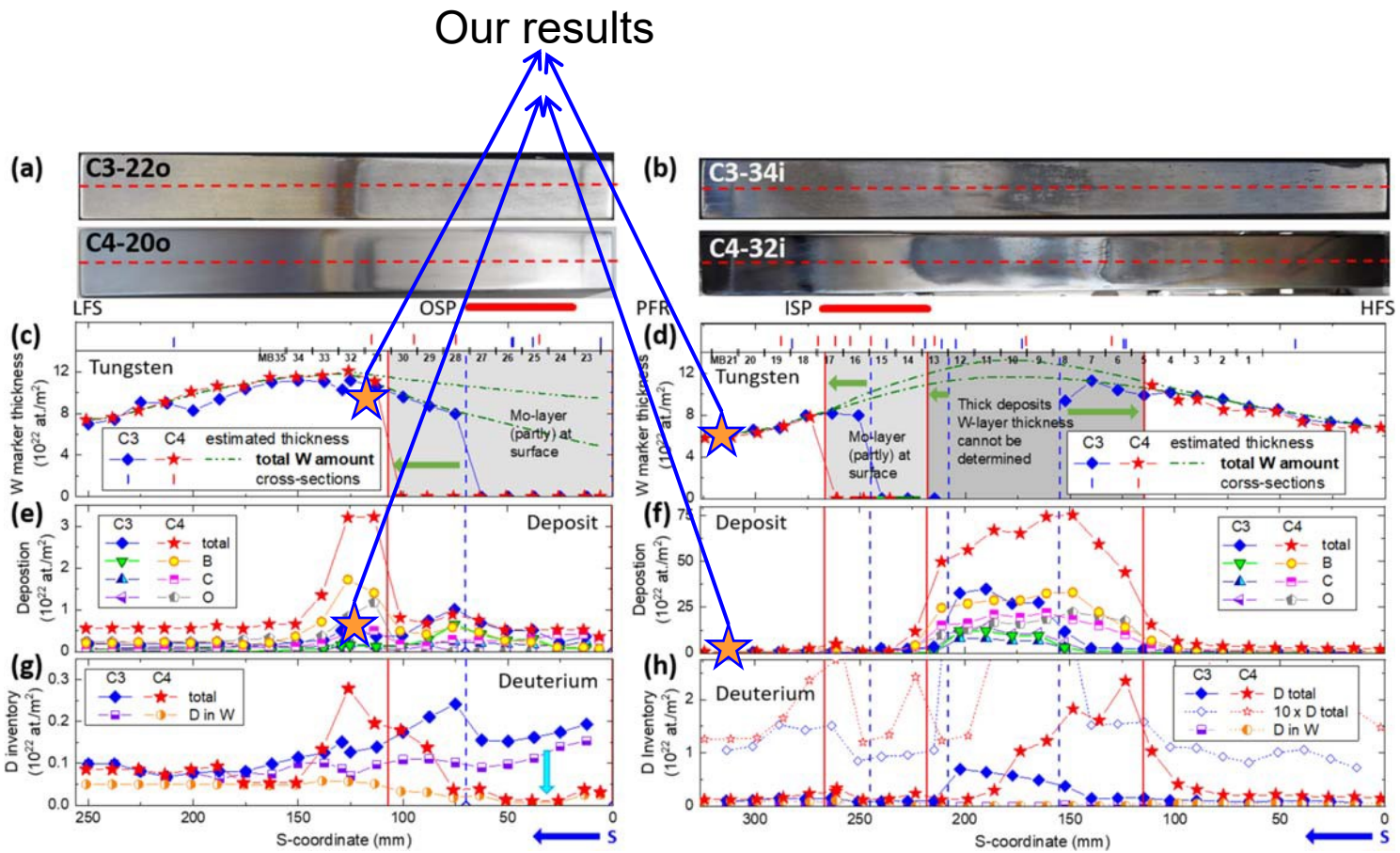
RBS/NRA measurements using a deuteron beam (1.35 MeV, detection angle 170°)



	This study					M Balden et al (2021)
Sample	**C content** (10^{17}at/cm^2)	**C layer thickness** (nm)	**O content** (10^{17} at/cm^2)	**O layer thickness** (nm)	**W top layer content** (10^{18}at/cm^2)	**W top layer content** (10^{18} at/cm^2)
C3-22o G	2.00	64	3.36	173	8	10
C3-34i Q	3.01	80	5.00	160	3	6

- Surface layers of about 200 nm thickness rich in C and O (45 - 50 at%)
- No observed erosion for W top layer in C3-22oG, while C3-34iQ has suffered erosion of about 0.5 μm.
- The results in broad agreement with those of M. Balden et al Phys. Scripta (2021)

RBS/NRA results – Comparison with literature

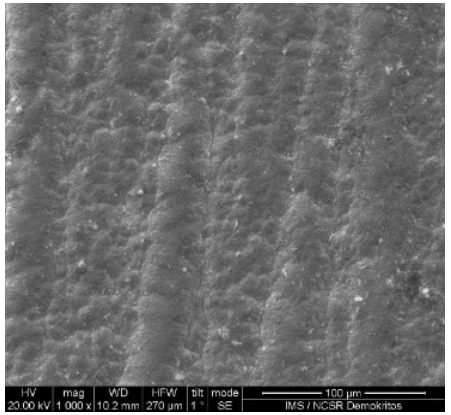


M. Balden et al. Physica Scripta (2021)

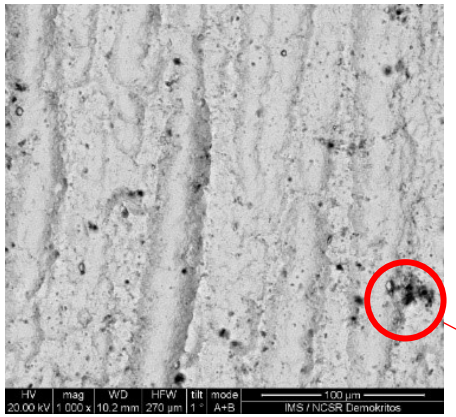
Plasma exposed samples from WEST – SEM/EDS results

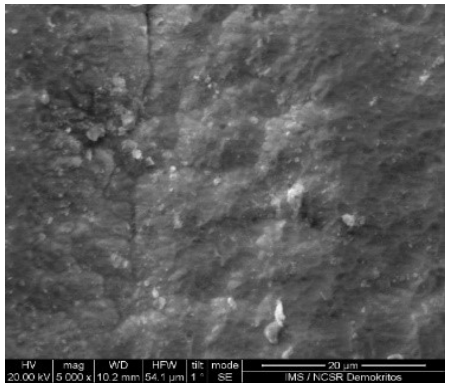
C3-22oG

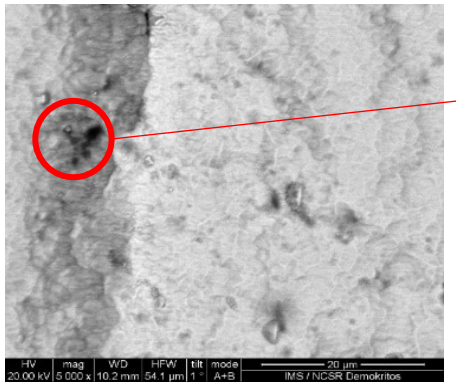
SE



BSE

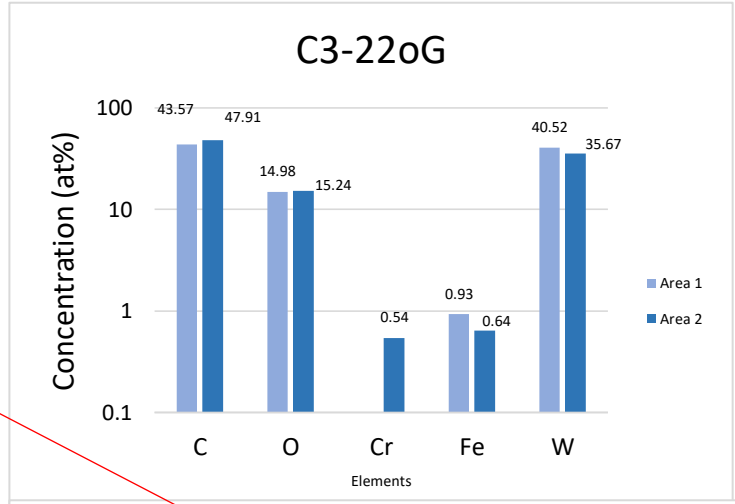


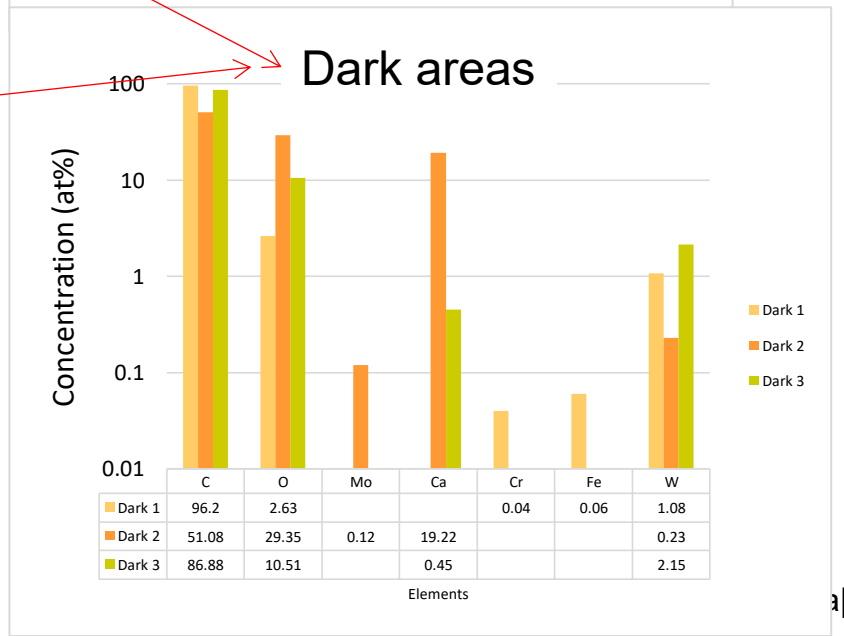




Elemental Composition

Averaged over large areas





	C	O	Mo	Ca	Cr	Fe	W
Dark 1	96.2	2.63			0.04	0.06	1.08
Dark 2	51.08	29.35	0.12	19.22			0.23
Dark 3	86.88	10.51		0.45			2.15

Apart from C and O, Fe and Cr are detected

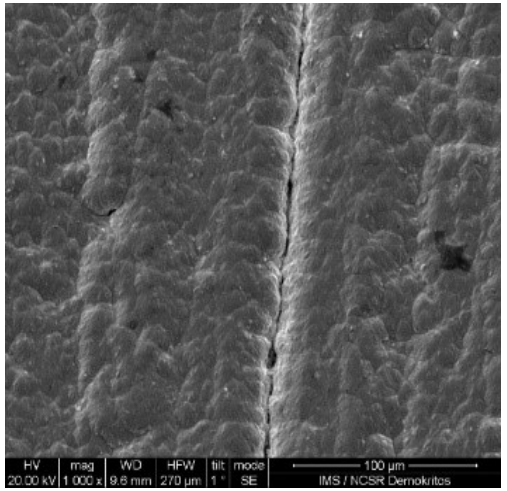
- Fe: 0.6-0.9 at%
- Cr: 0-0.5 at%

The dark spots in BSE mode are areas rich in C

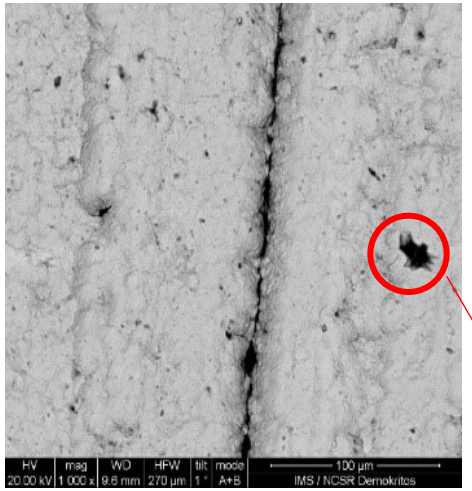
Plasma exposed samples from WEST – SEM/EDS results

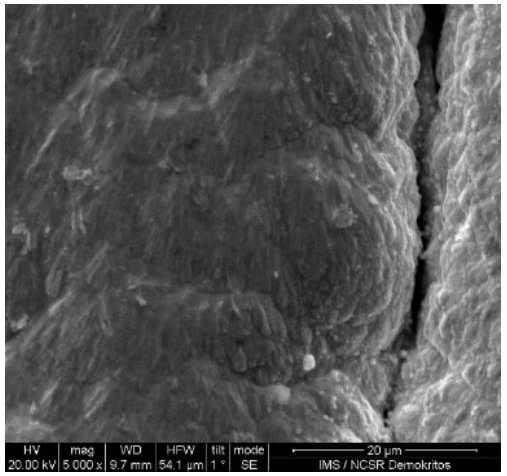
C3-34iQ

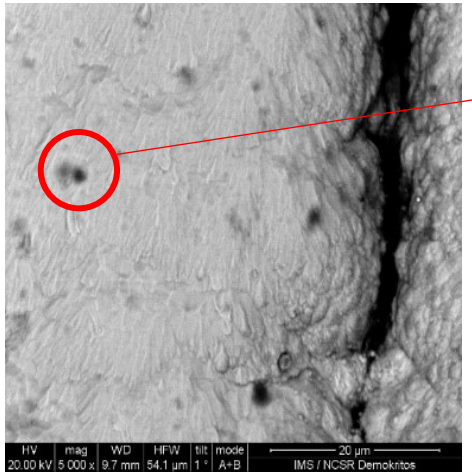
SE



BSE

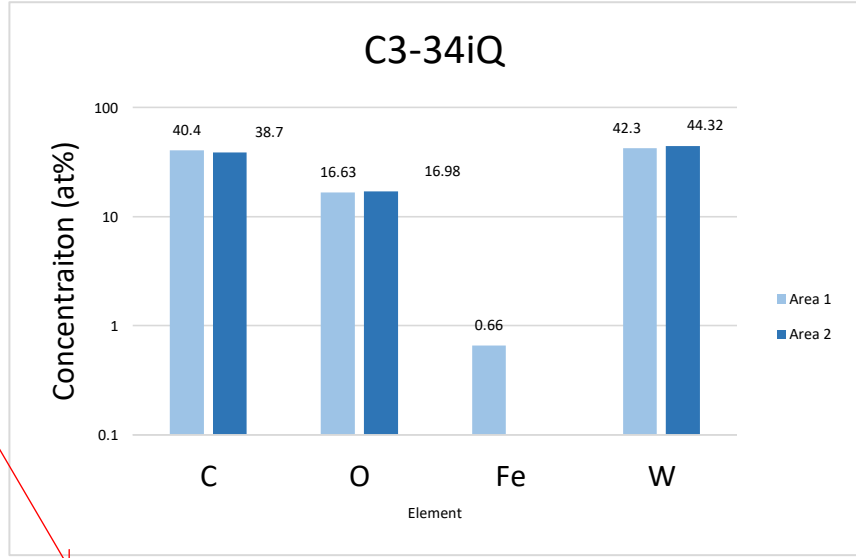


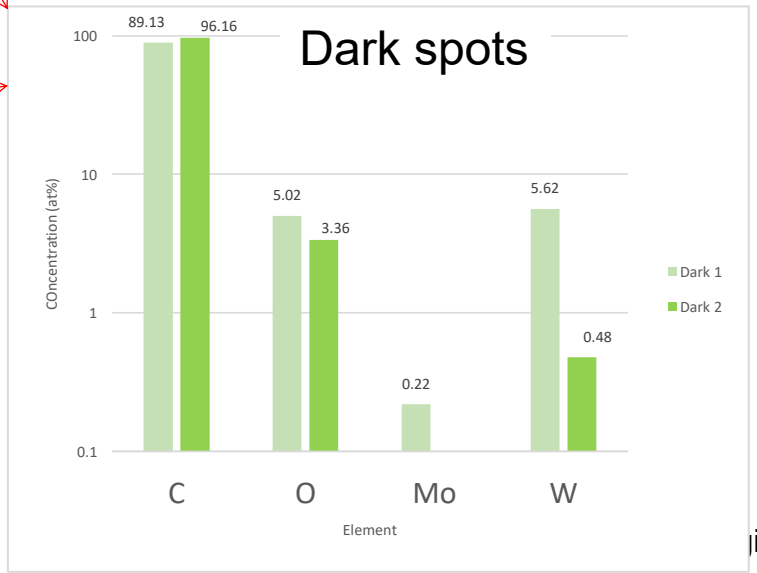




Elemental Composition

Averaged over large areas

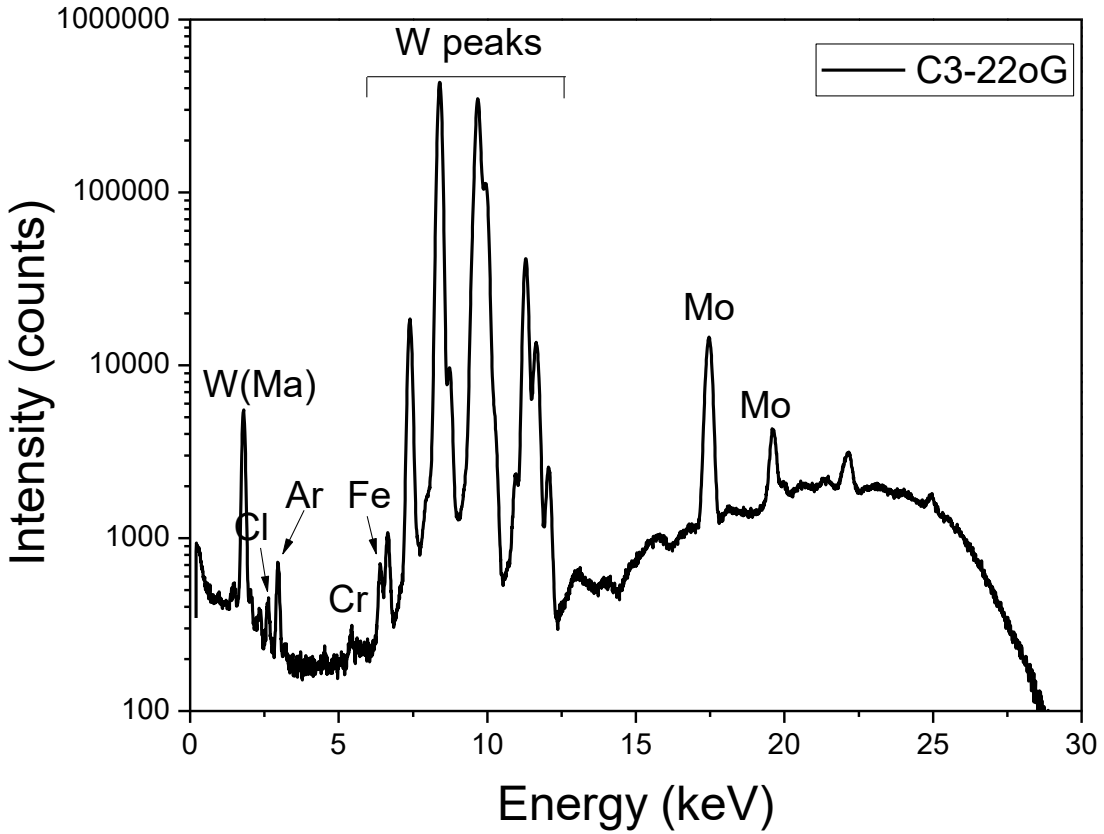




Apart from C and O, Fe is detected up to 0.77 at%

The dark spots in BSE mode are areas rich in C

XRF results



C3-22oG		C3-34iQ	
Element	**at%**	**Element**	**at%**
Cr	0.08	**Cr**	0.06
Fe	0.25	**Fe**	0.28
Mo	4.7	**Mo**	4.7
W	94.97	**W**	94.96

Fe and Cr deposition of similar concentration is detected on both samples in agreement with EDS analysis.

Summary

WEST **C3-22oG** and **C3-34iQ** samples

- No erosion in C3-22oG while C3-34iQ has suffered erosion of about 0.5 μm (in agreement with M. Balden et al Phys. Scripta (2021))
- C, O, Fe and Cr deposition is found on both samples
  - C up to about 80 nm depth
  - O up to about 200 nm depth
  - Fe and Cr less than 1 at%
- Islands rich in carbon are found on both samples