

Increased fuel flexibility and performance for boilers with challenging fuels

Rikard Norling

Alice Moya Núñez, Clara Linder,
Melina da Silva

KME conference 06.03.2023



RI.
SE

Increased fuel flexibility and performance for boilers with challenging fuels

- Calderys
- E.ON
- Energiforsk
- Falu Energi & Vatten
- Högskolan Väst
- Kanthal
- MH Engineering
- Mälarenergi
- Stockholm Exergi
- RISE
- Valmet
- Vattenfall
- *Energimyndigheten*

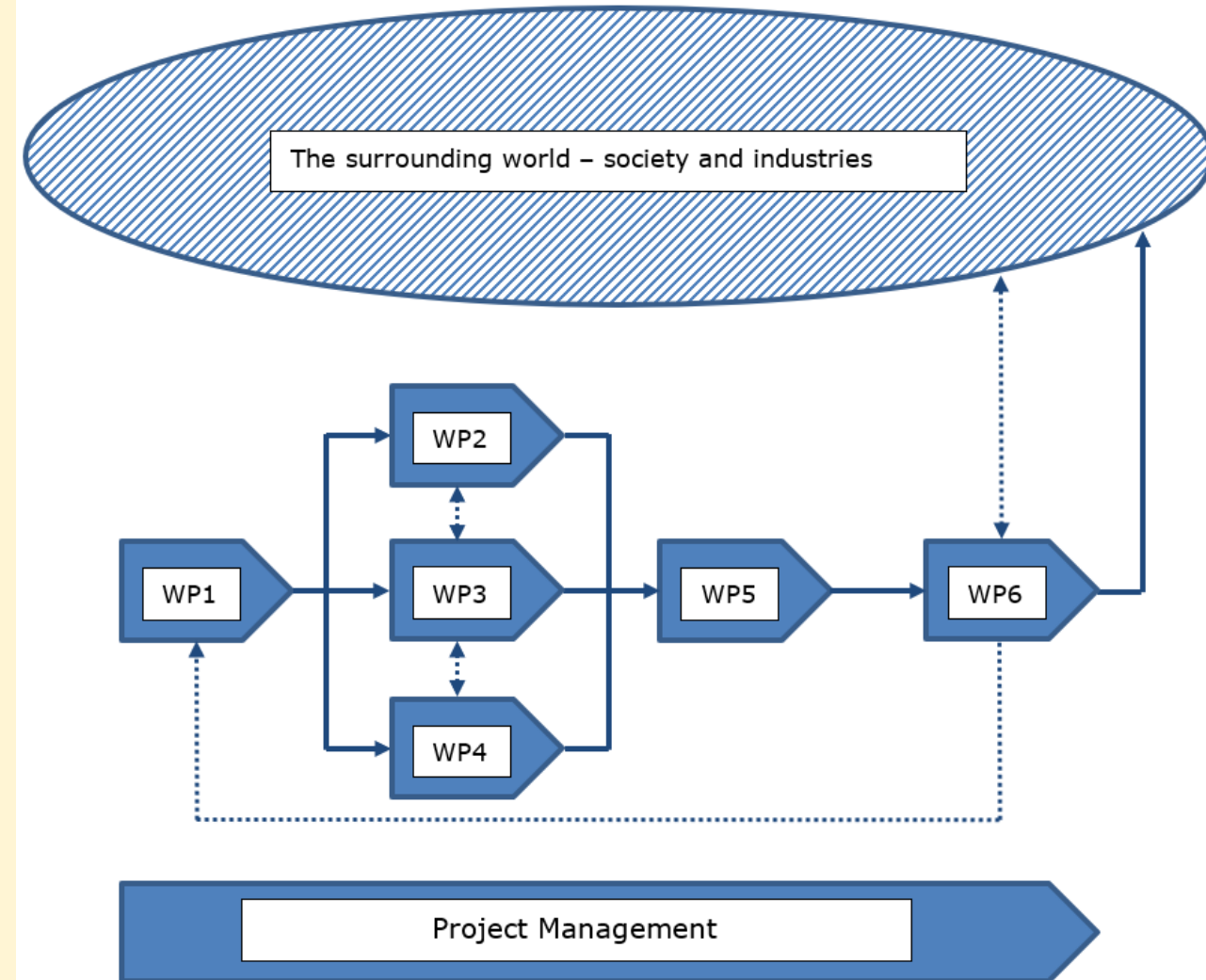
Background

- Biomass-based fuels often imply an elevated risk of corrosion caused by chlorides and alkali metals
- An additional challenge with recycled wood and waste is their content of paint, plastics and metals
 - This results in high content of heavy metals (e.g. Pb and Zn) and chloride causing increased corrosion



Contents

- WP1 – Challenges and possibilities
- WP2 – Performance of cooled metallic parts
- WP3 – Performance of uncooled metallic parts
- WP4 – Refractories
- WP5 – Excellence in performance
- WP6 – Co-operation and communication



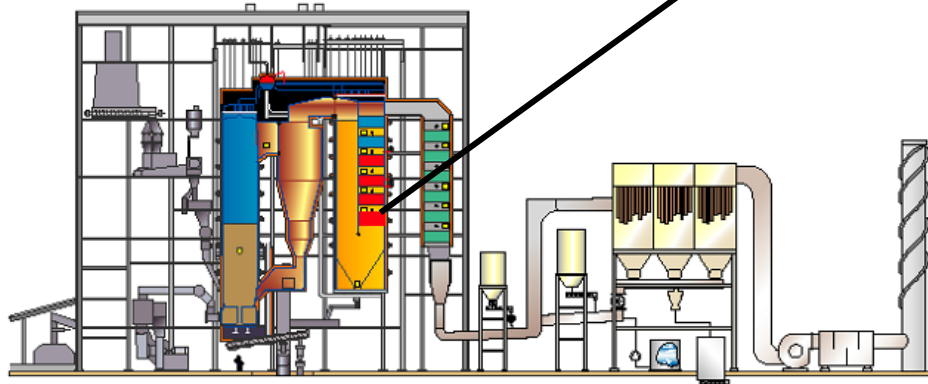
Selection of project goals

- To obtain new knowledge on how heavy metals in deposits influence corrosion of cooled parts
- To identify 1-2 coating candidates with the potential to improve the life performance by 20 %
- To obtain new knowledge on how corrosive fuel components degrade refractories
- To identify 1-2 refractory material candidates with the potential to improve the life performance by 20 %
- To achieve an understanding for when refractories are particularly beneficial to be used for protection of underlying metal and when other corrosion prevention methods may be attractive

Performance of cooled metallic parts

Exposure – Tube shield evaluation

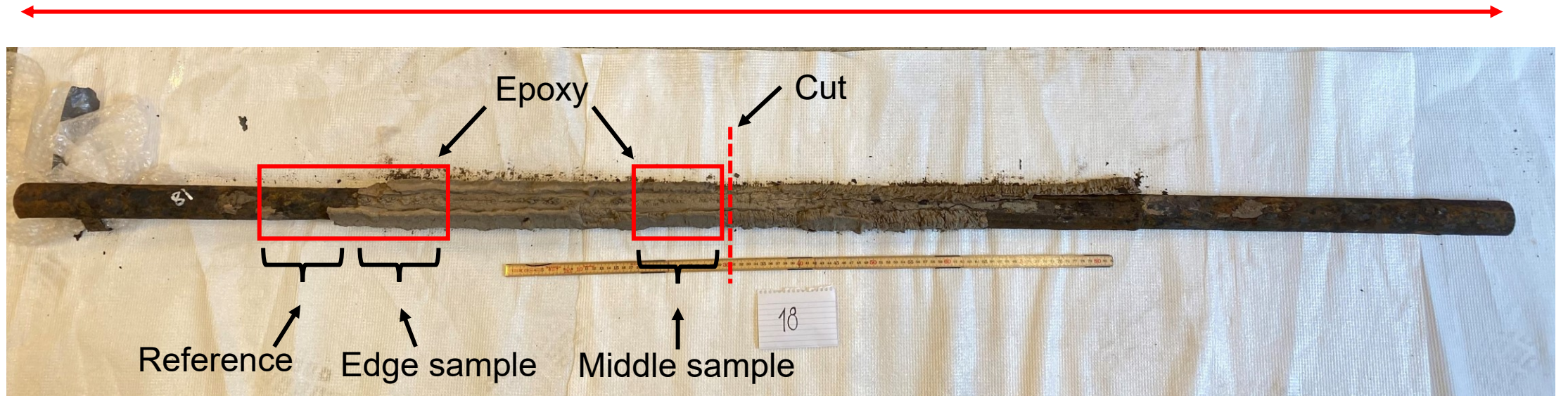
- Collaboration with FeCrAlCLAD- project, which produced the test tube shields and carried out the exposures, as well as some evaluation



Convection bank 1, "roof"		
Tube	12.	San 60
Tube	13.	EF101 (L197)
Tube	18.	APMT
Tube	21.	EF100 (L198)

Convection bank 0, "floor"		
Tube	6.	San 60
Tube	7.	EF100 (L198)
Tube	8.	EF101 (L197)
Tube	9.	APMT

180 cm



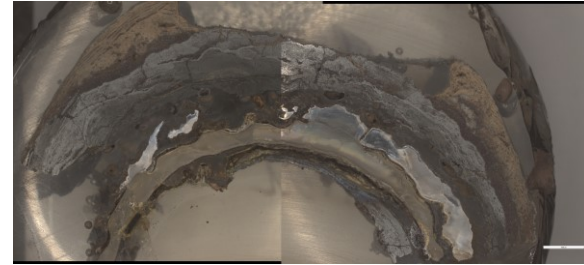
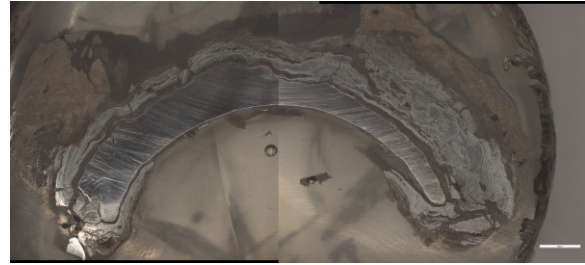
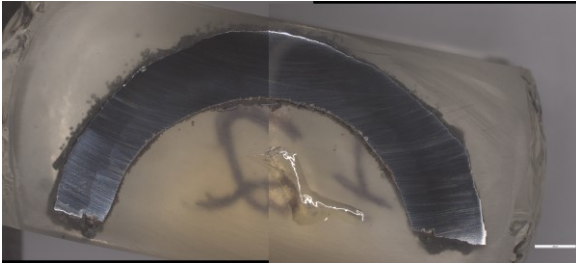
Tube no. 12 – San 60

Tube no. 21 – EF100 (L198)

Tube no. 13 – EF101 (L197)

Tube no. 18 - APMT

Roof



Mid

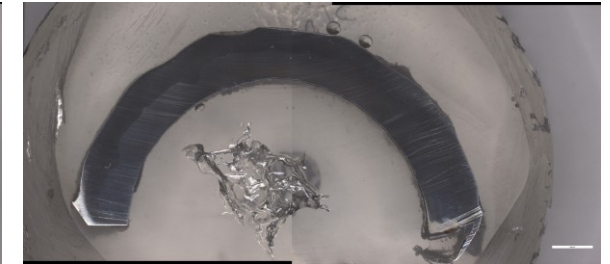
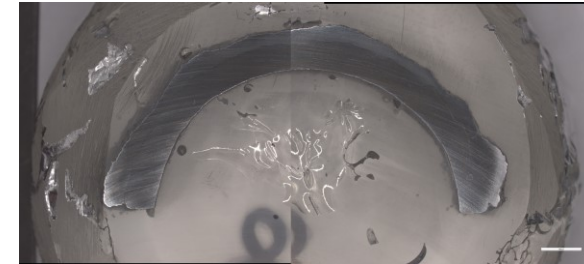
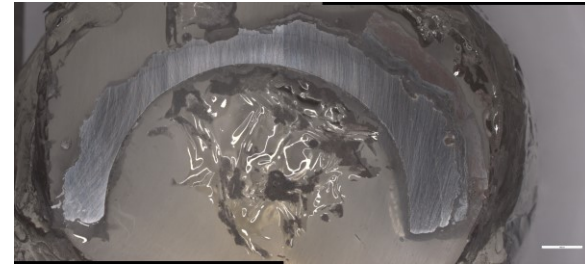
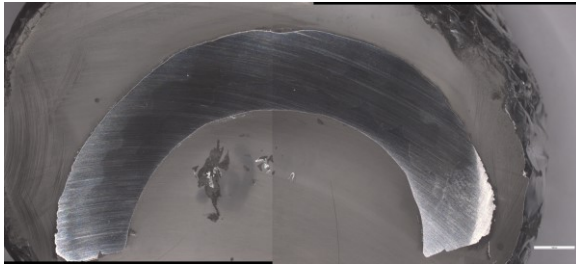
Tube no. 6 – San 60

Tube no. 7 – EF100 (L198)

Tube no. 8 – EF101 (L197)

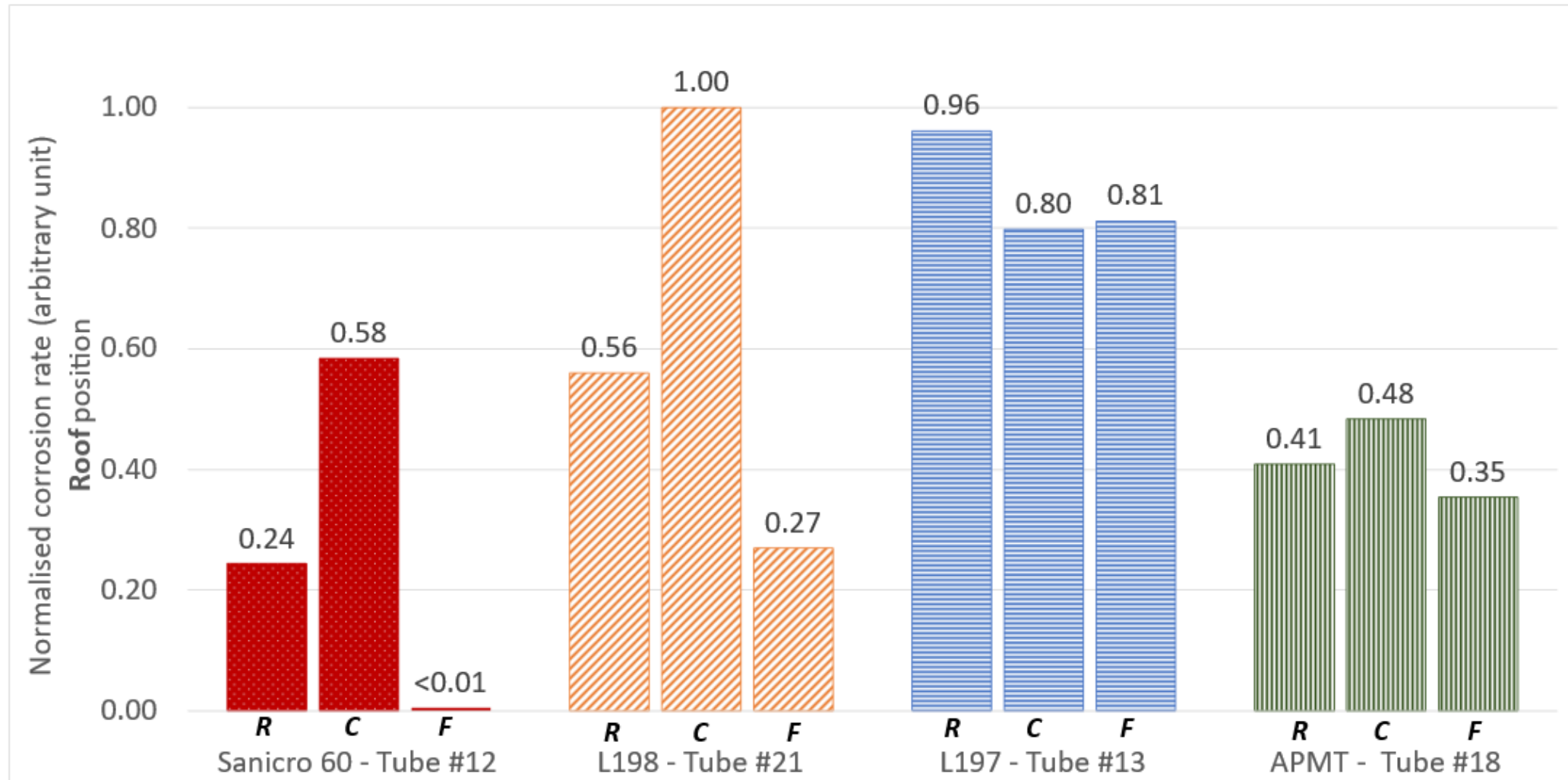
Tube no. 9 - APMT

Floor

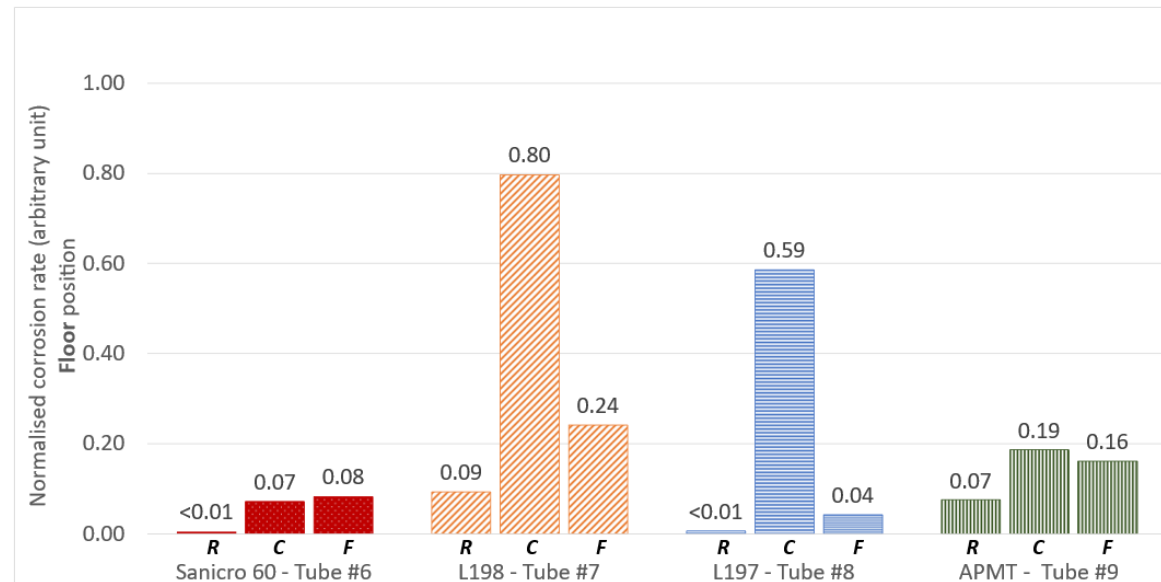
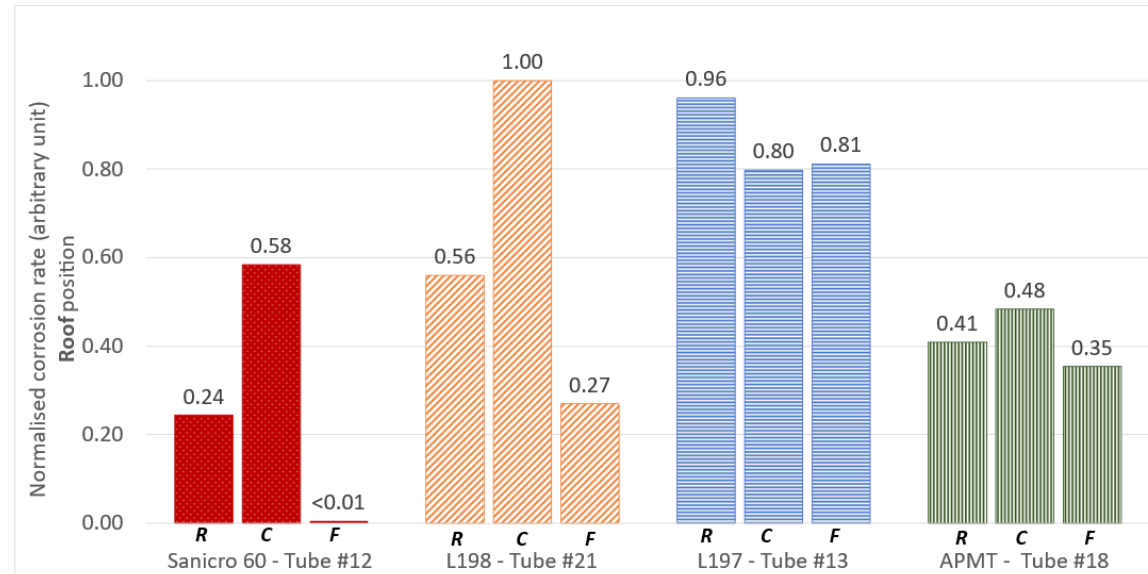


Mid

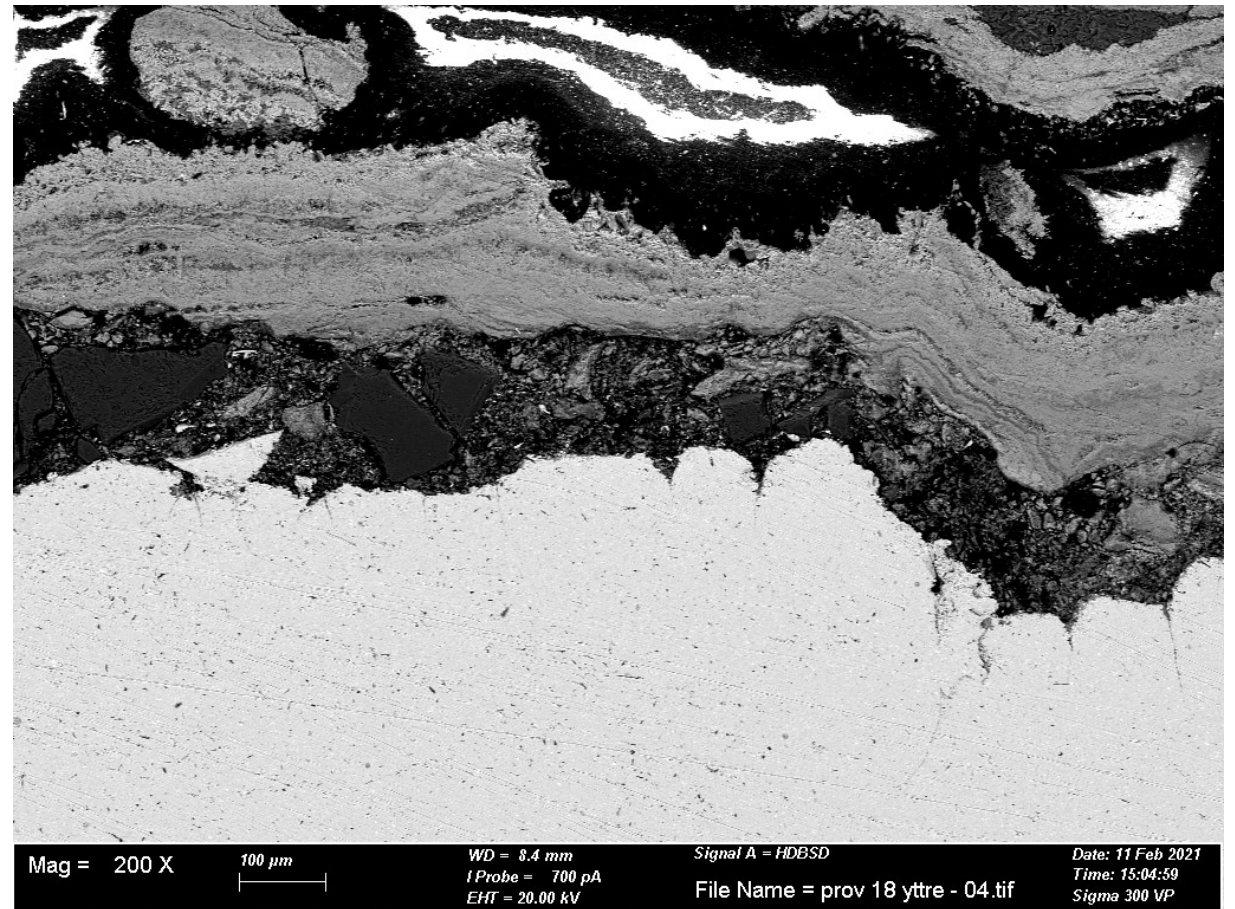
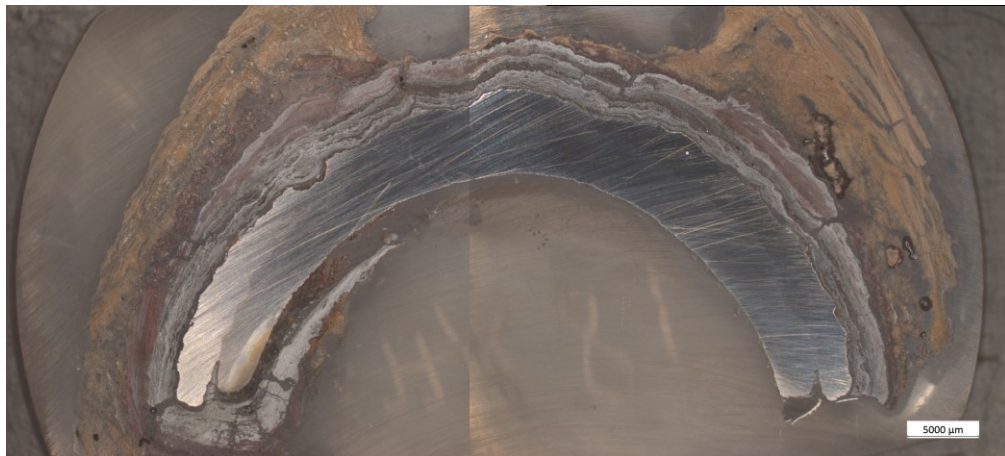
Material losses after a 6-month exposure



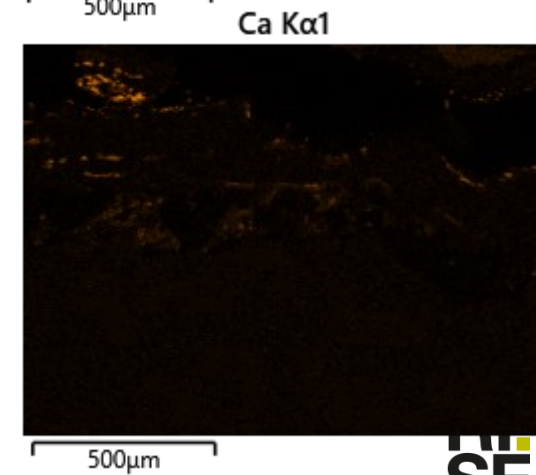
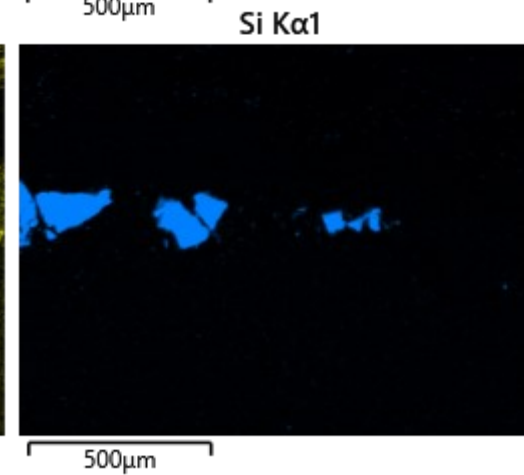
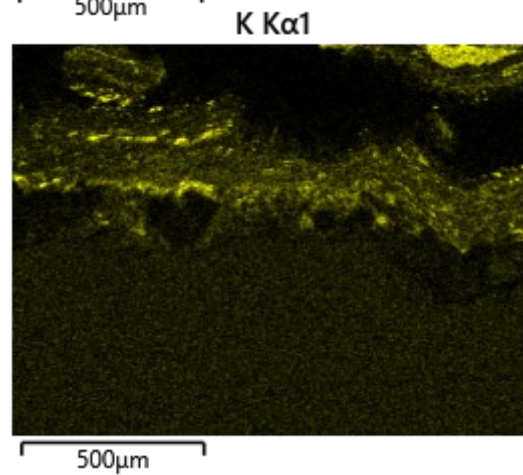
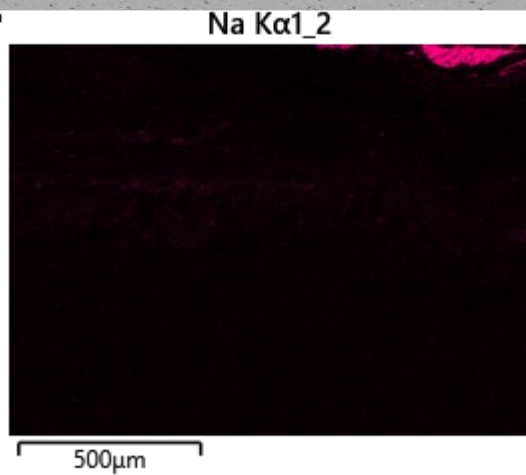
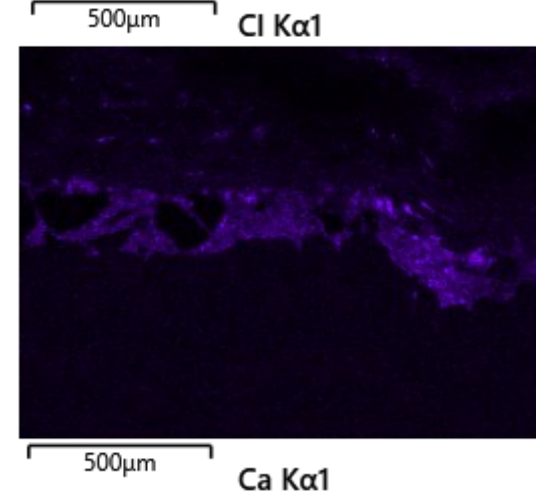
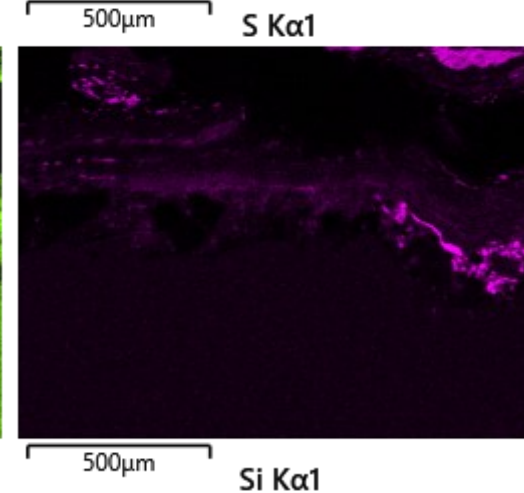
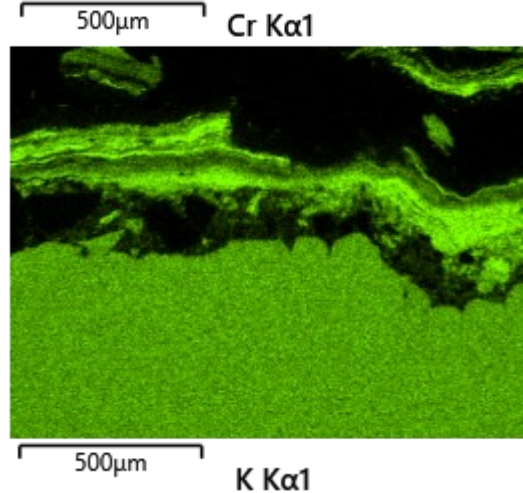
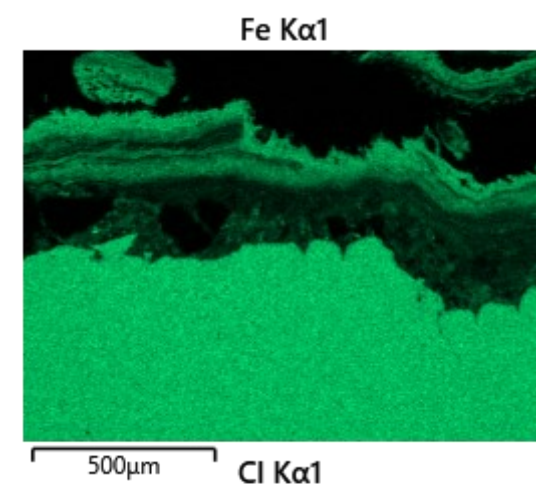
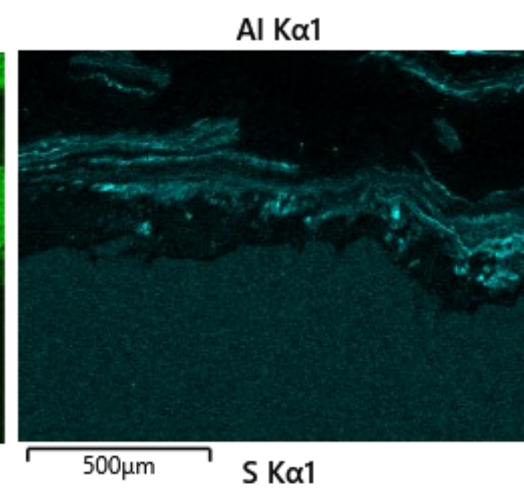
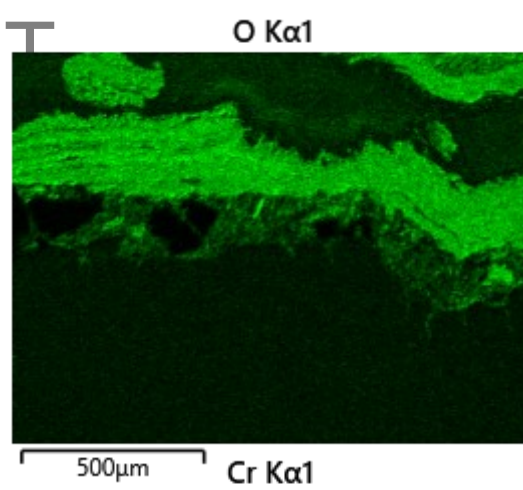
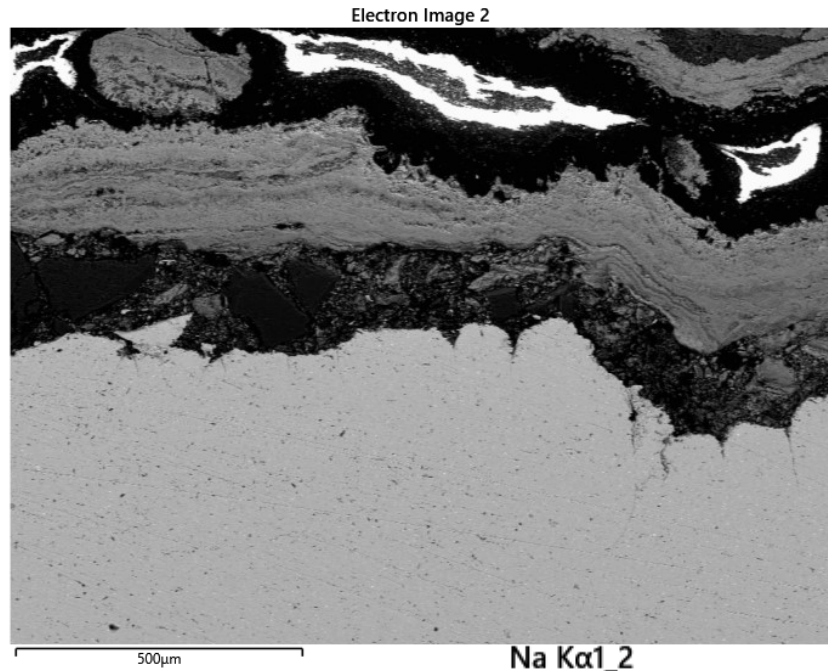
Material losses



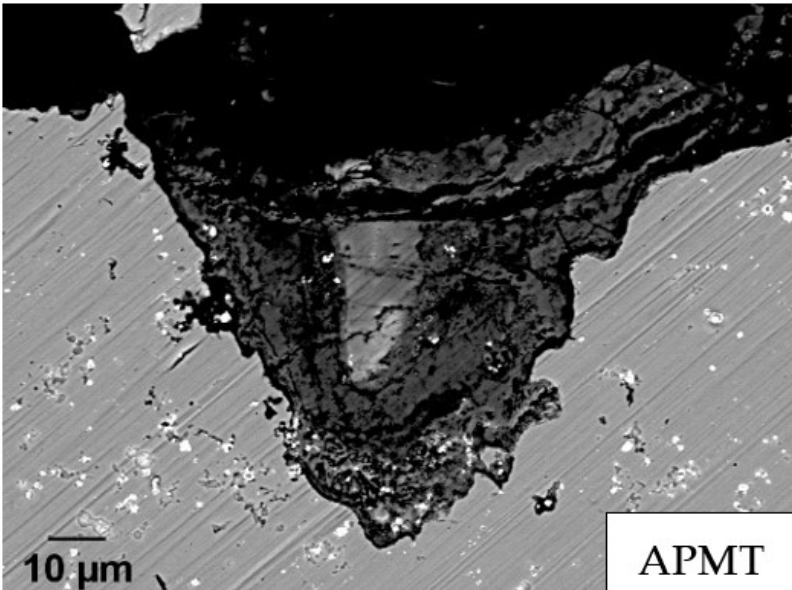
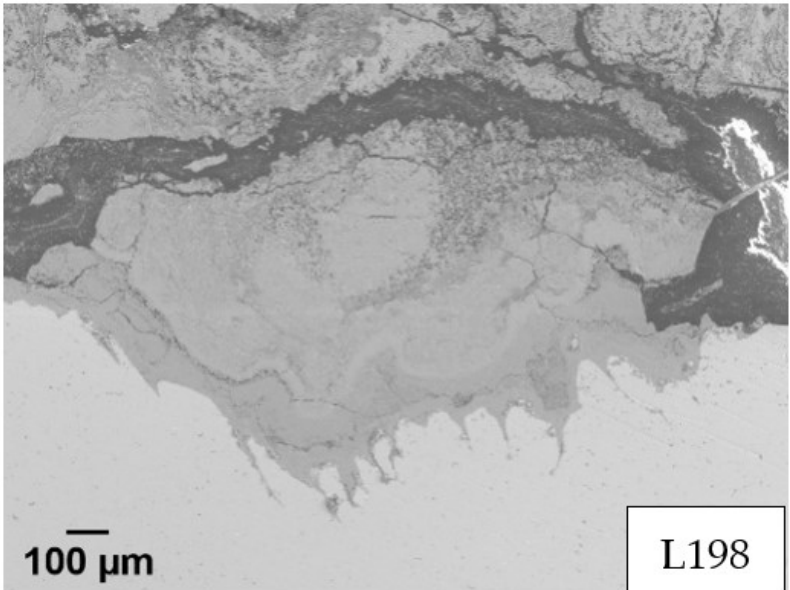
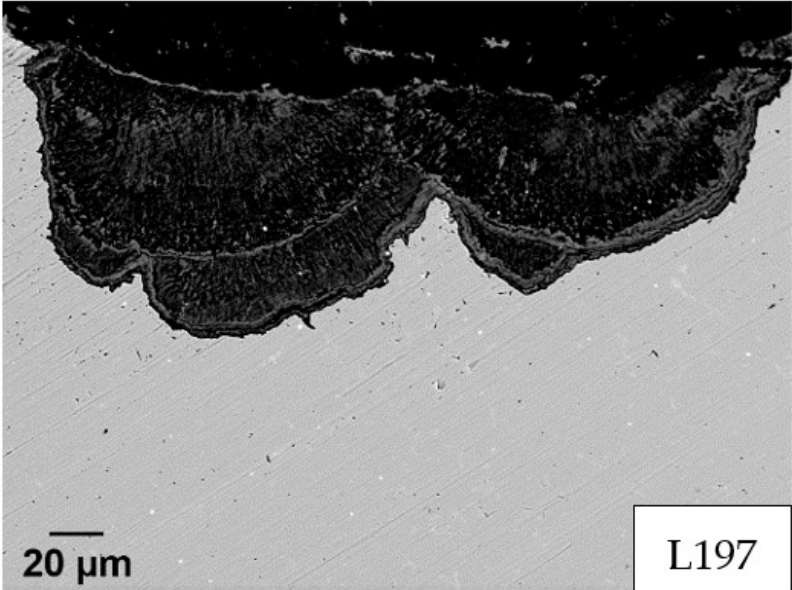
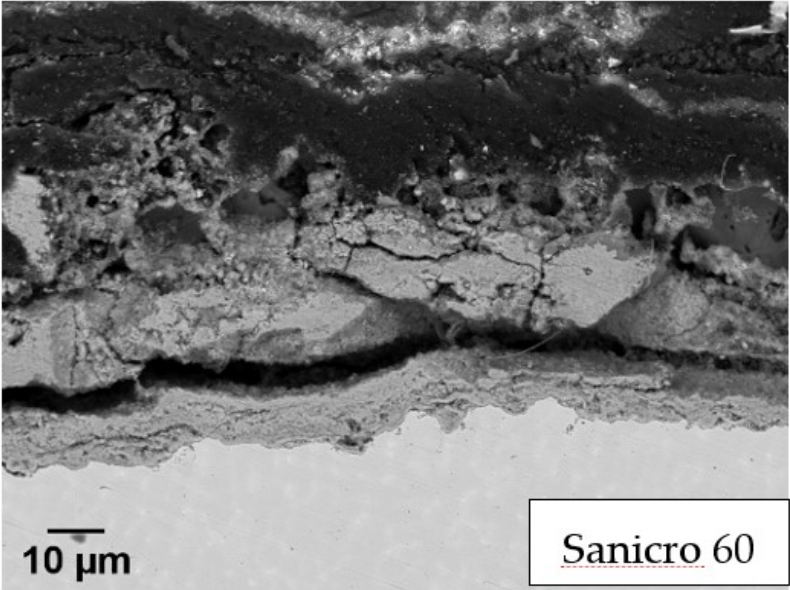
Tube no. 18 Edge - APMT



Tube no. 18 Edge - APMT



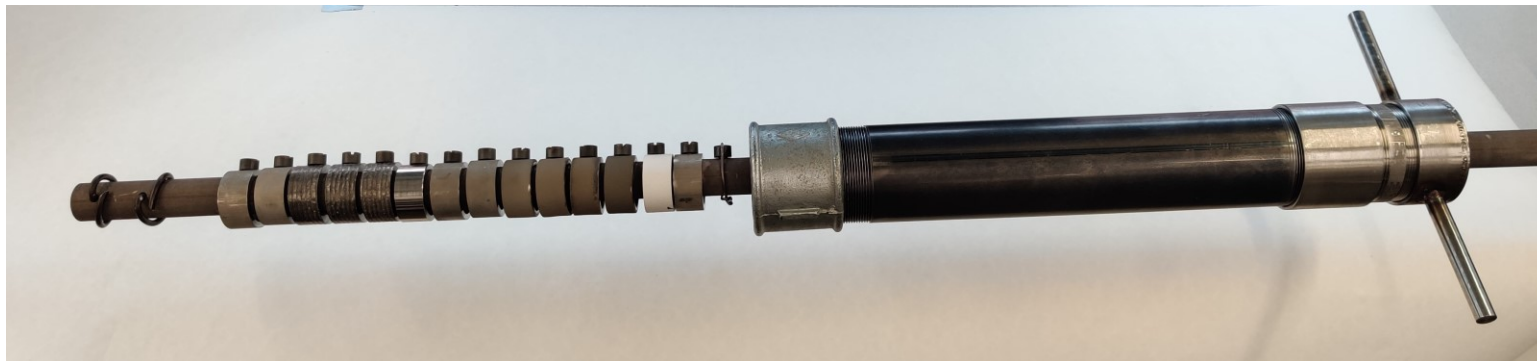
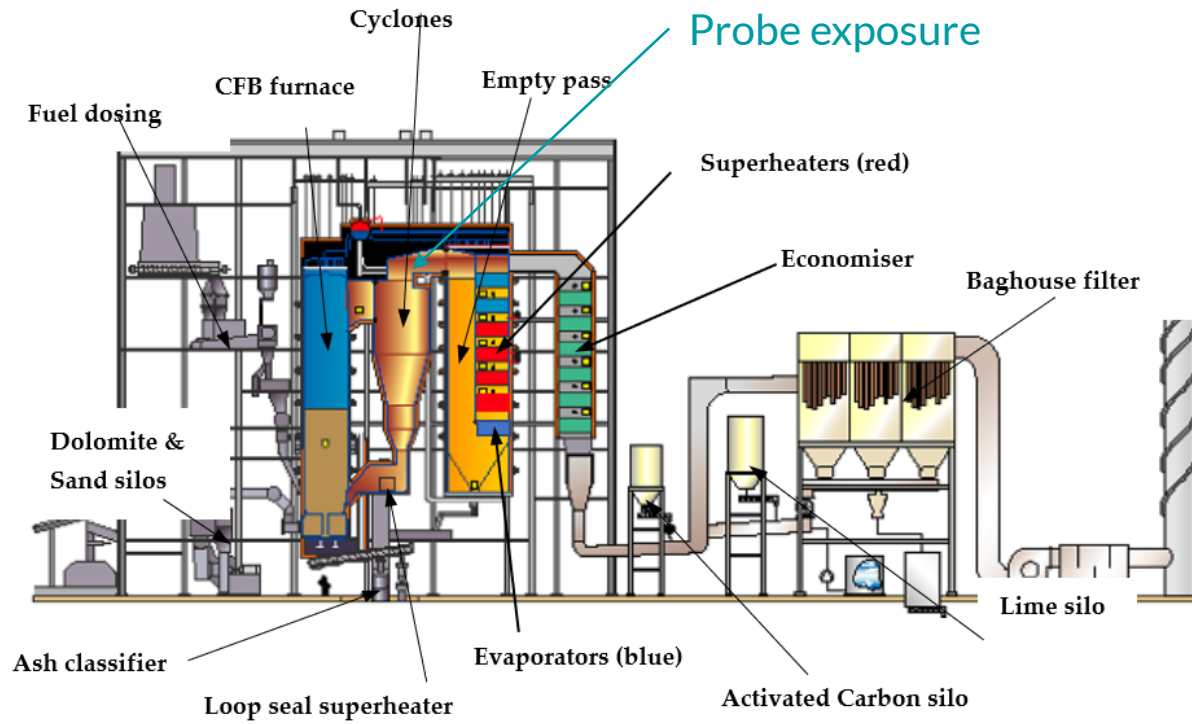
Corrosion attack morphology after a 6-month exposure



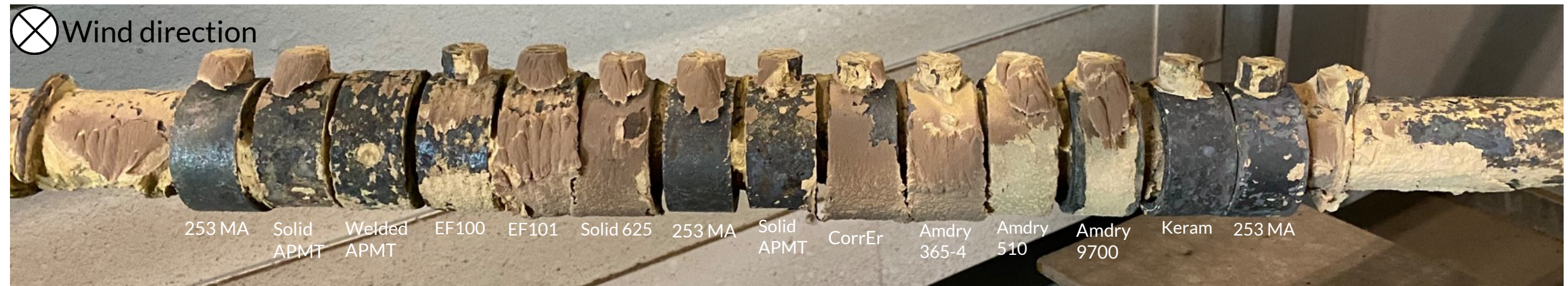
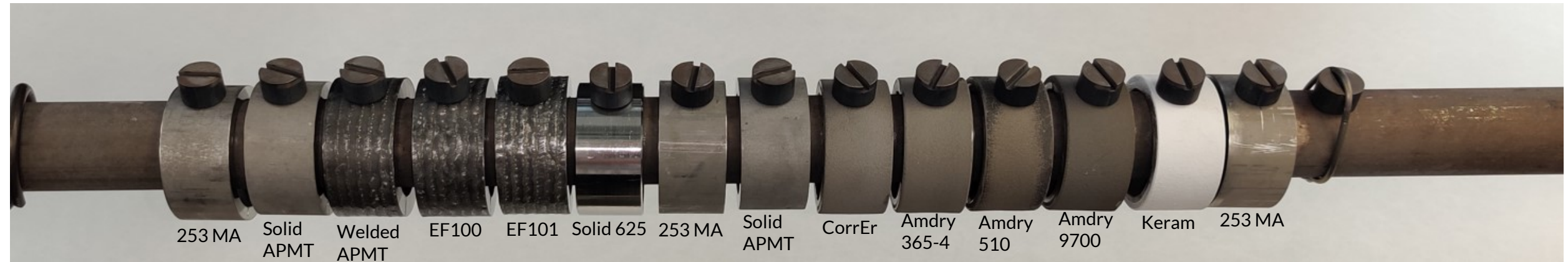
Performance of uncooled metallic parts

- Many components other than tubing, and that are mostly uncooled, such as cyclone vortex finder, supports, hangers, plates, refractory anchors and nozzles, frequently experience short life.
- Being uncooled these parts operate at a high temperatures giving intrinsically different challenges compared to cooled parts, as e.g. condensed phases in the deposits are expected to be different.

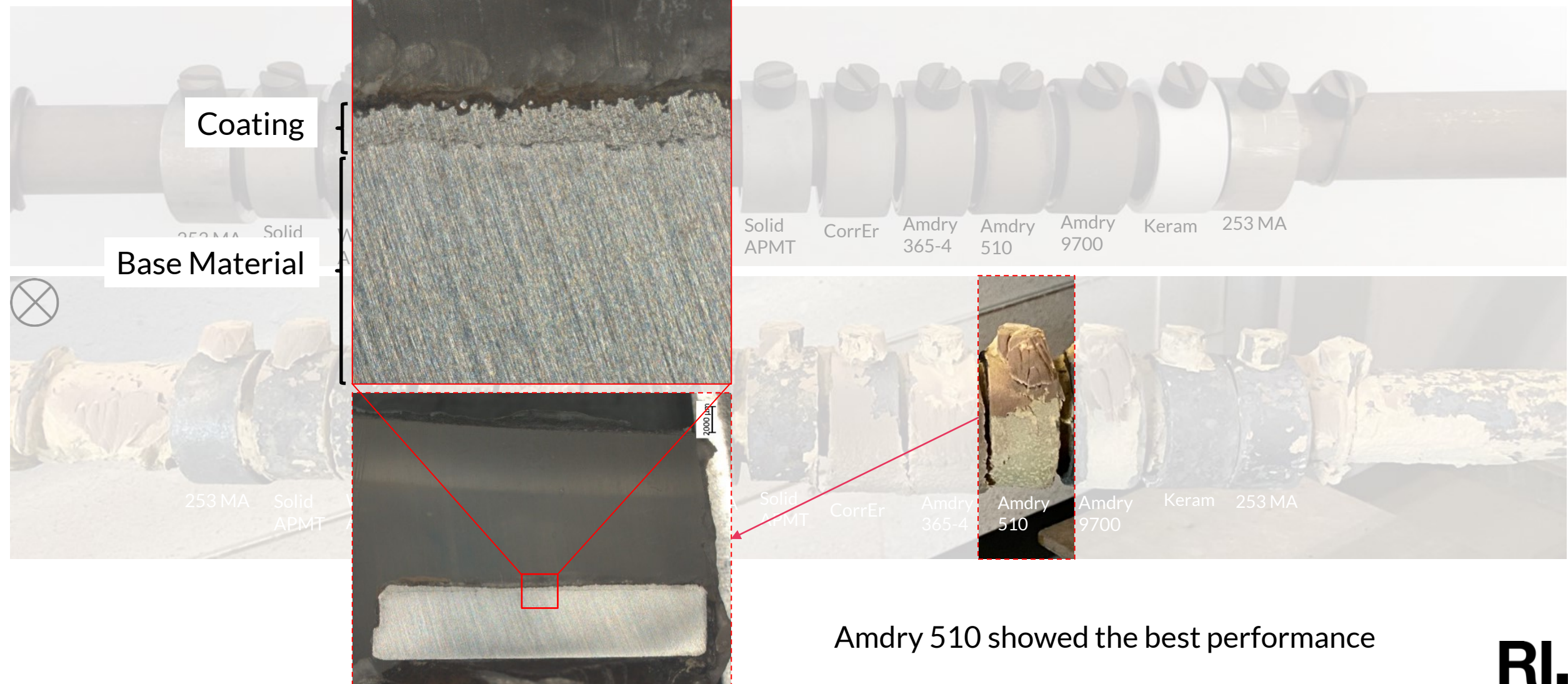
Uncooled metallic parts: Probe exposure



Uncooled metallic parts: Probe exposure



Uncooled metallic parts: Probe exposure



Amdry 510 showed the best performance

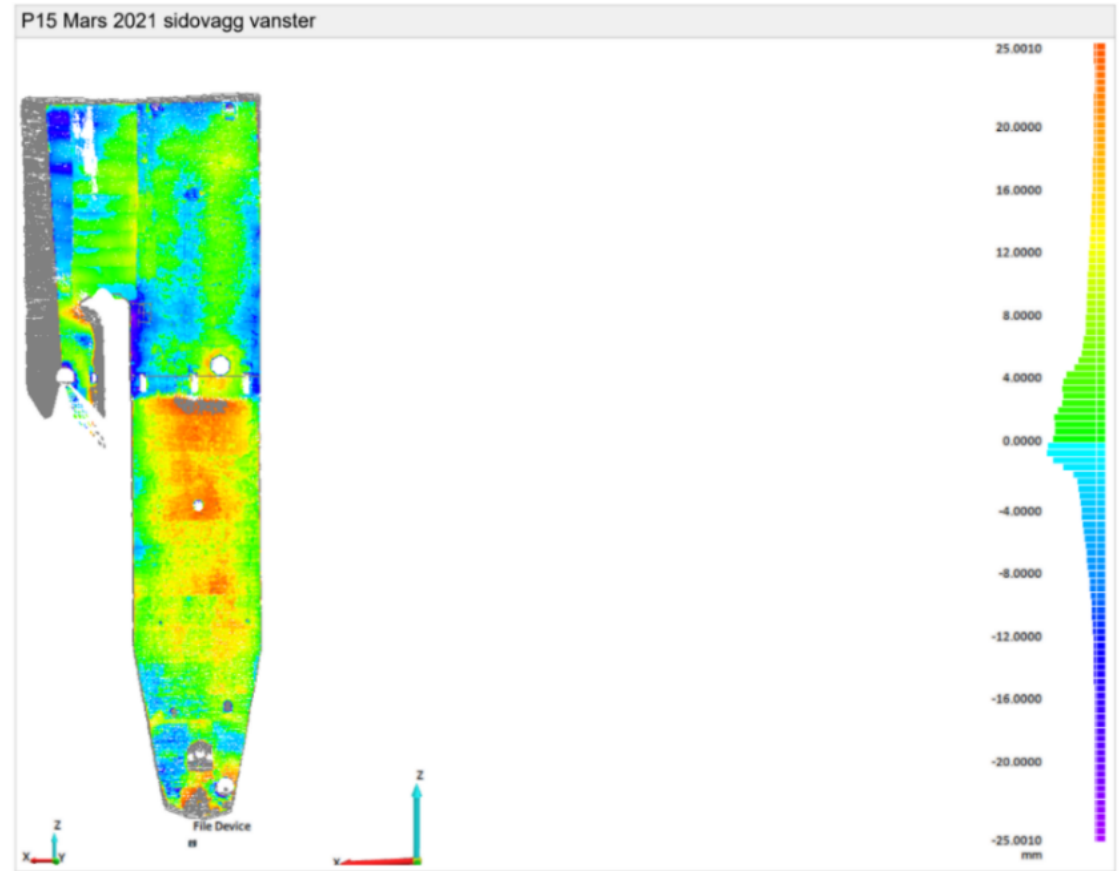
Refractories

- Example of challenges encountered

Calderys is acknowledged for providing the image



Refractories

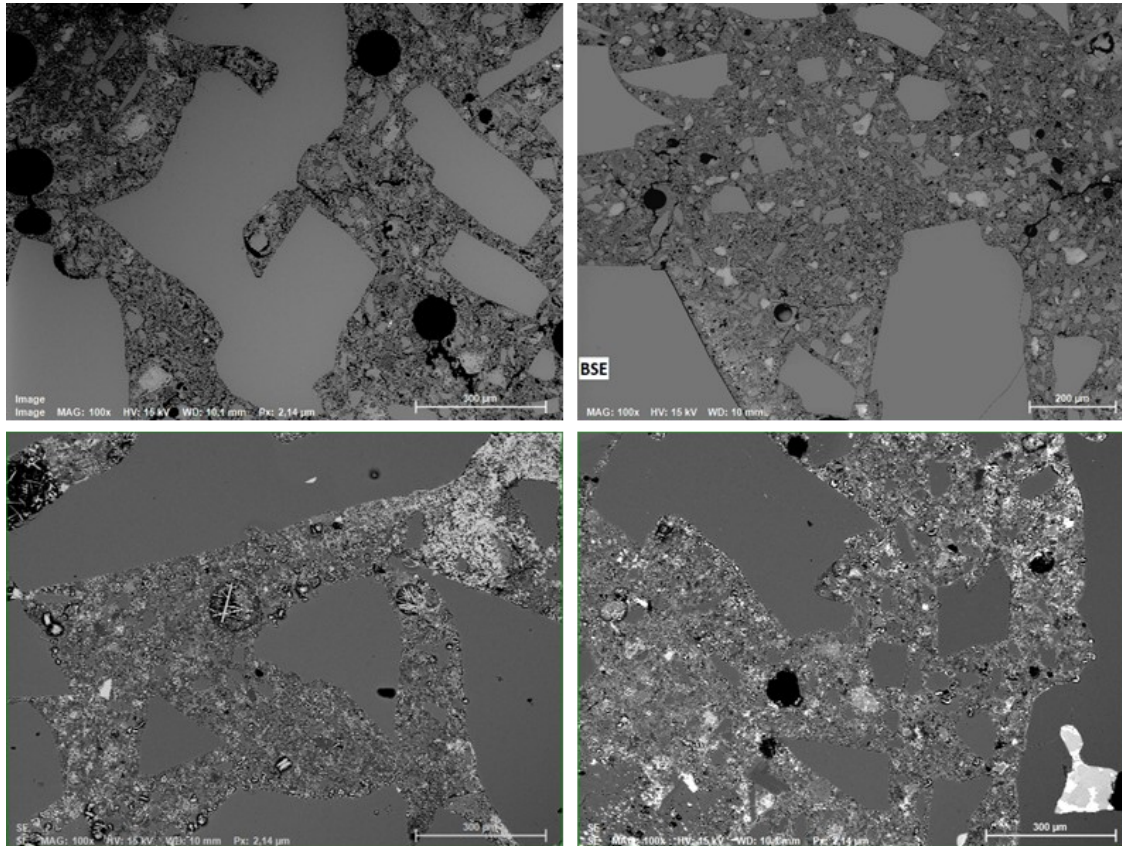


Surface Deviation Analysis1

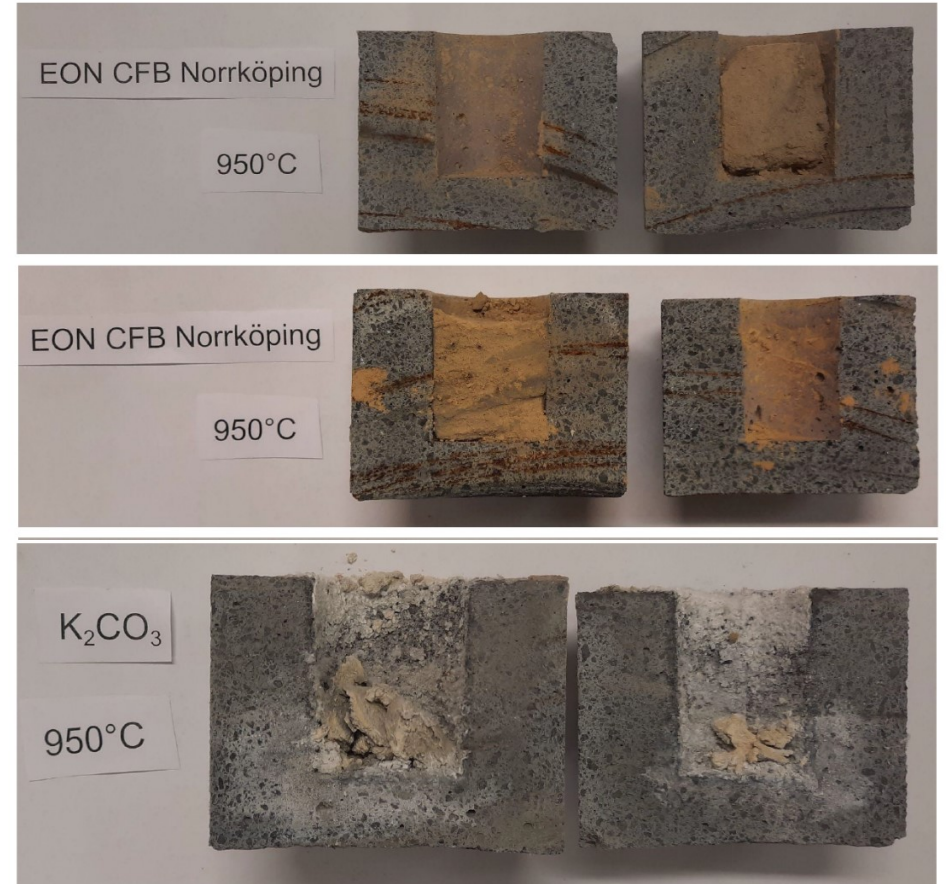


Highest	Cloud2_In_In:58926776	○	25.0000	Lowest	Cloud2_In_In:33521959	○	-25.0000
Below	0	In Tol.	48994431	Above	0	Avg.	1.5779
-25.0010	0.00%		100.00%	25.0010	0.00%	Std. Dev.	6.9373
						RMS	7.1145

Refractories



Field samples up to 7 years exposure



Short term Lab test

Selected Conclusions

- The metallographic investigation resulted in a materials ranking regarding the overall metal loss of new overlay weld coatings.
- HVOF applied Amdry 510 coating has potential to improve material performance significantly for uncooled parts.
- Refractory materials evaluated in this study are shown to be very resistant against alkali compounds.

Thank you for listening!