KME 715 – Composite Metal Polymer (CMP) for non-stick improvements in CHP plants

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Background – deposits on boiler components

- Generates high outage maintenance cost and decreases availability of the plant
- Decreases electrical efficiency of the boiler
- Important factor for corrosion issues in high temperature boiler components such as furnace walls and superheaters
- Also of importance at lower temperatures in the economiser and cone of electrostatic precipitator

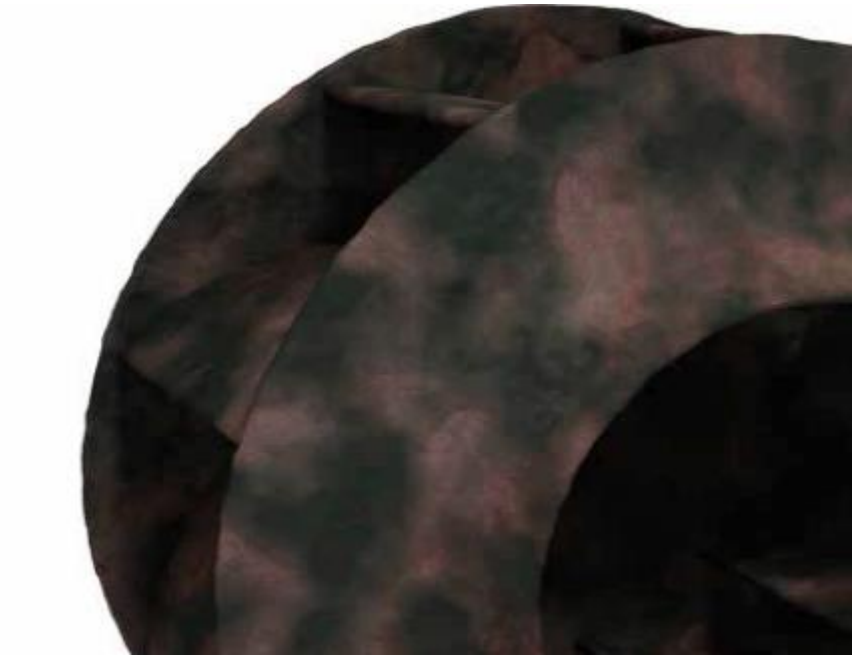
Motivation for the project

From the Project Agreement:

Through surfaces that keep cleaner in both furnace and convection parts the following advantages are achieved for combined heat and power (CHP) plants:

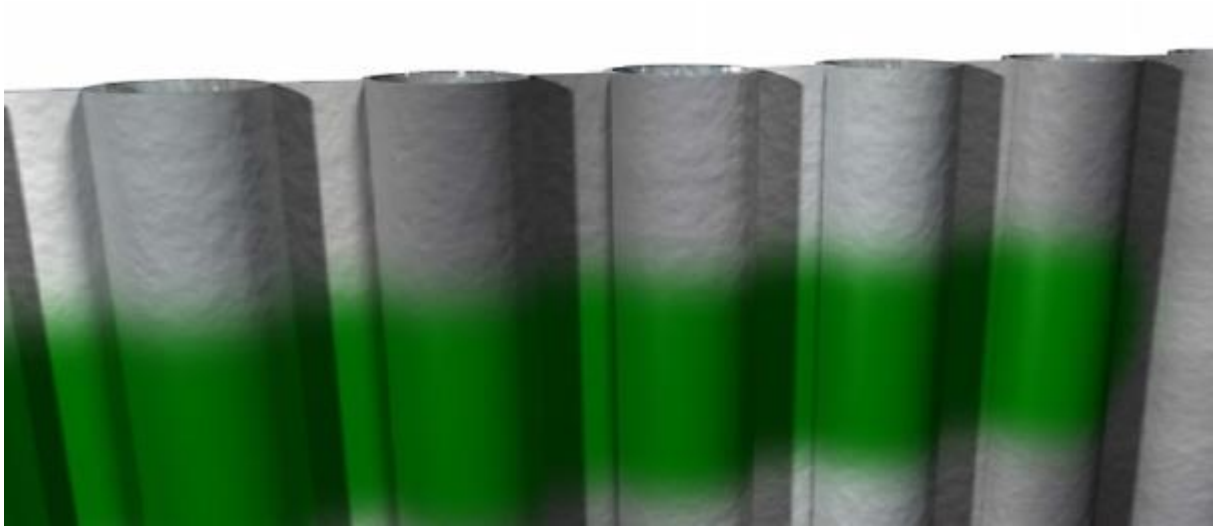
- Increased electrical efficiency
- Increased fuel flexibility
- Decreased maintenance costs related to corrosion and erosion damages
- Increased availability in general through minimised planned and unplanned down-time
- Increased operation time during top load periods through minimised unplanned down-time

Background – use of the dual non-stick layer at low temperature – flue gas recirculating fan



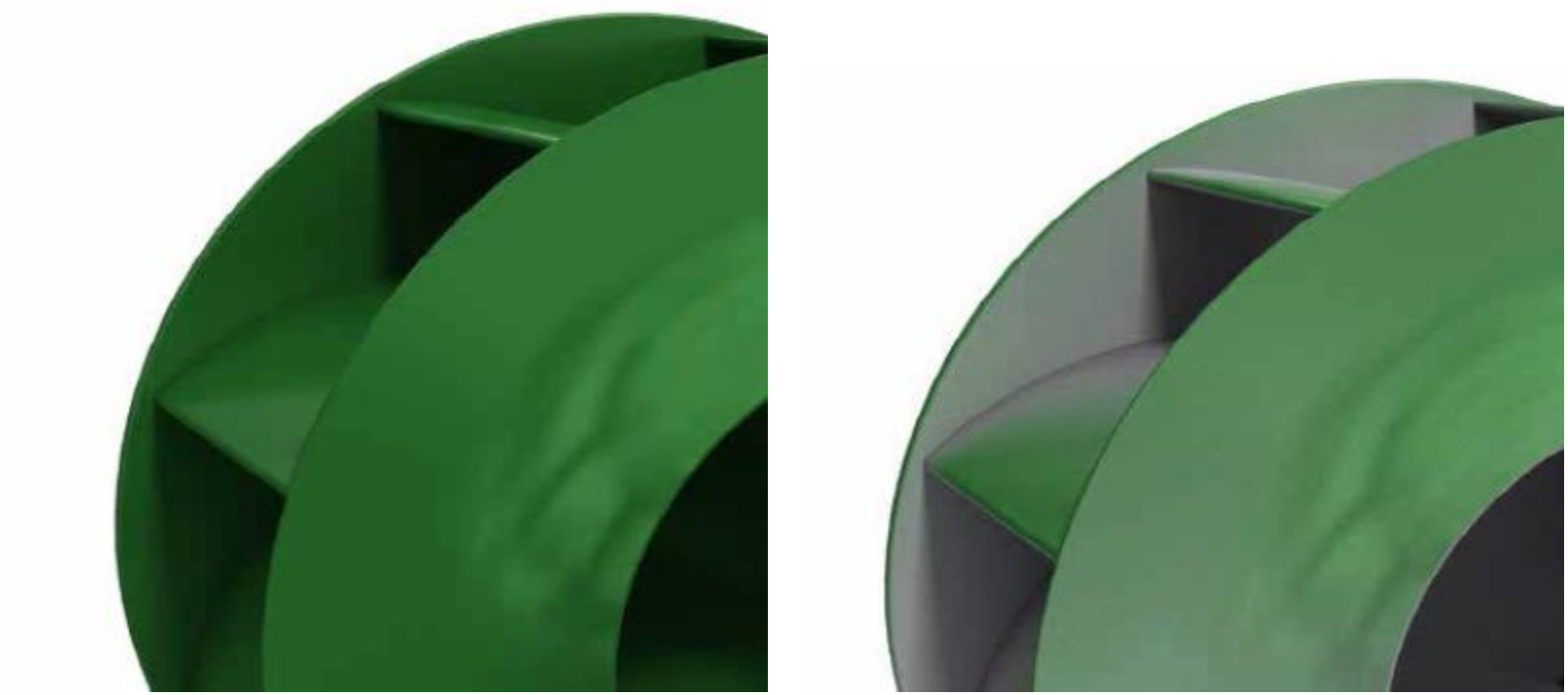
- Fan needed cleaning every week

Background – Application of the layer



- A Ni-base material is applied to the C-steel (grey)
- On top of this layer, the non-stick material is deposited (green)

Background – use of the dual non-stick layer at low temperature – flue gas recirculating fan



- Ni-base and non-stick material were applied (left schematic)
- After one firing season, no cleaning had been needed (right schematic)
- Apparently, some non-stick material was still left

Background – schematic of non-stick layer after use

Non-stick layer

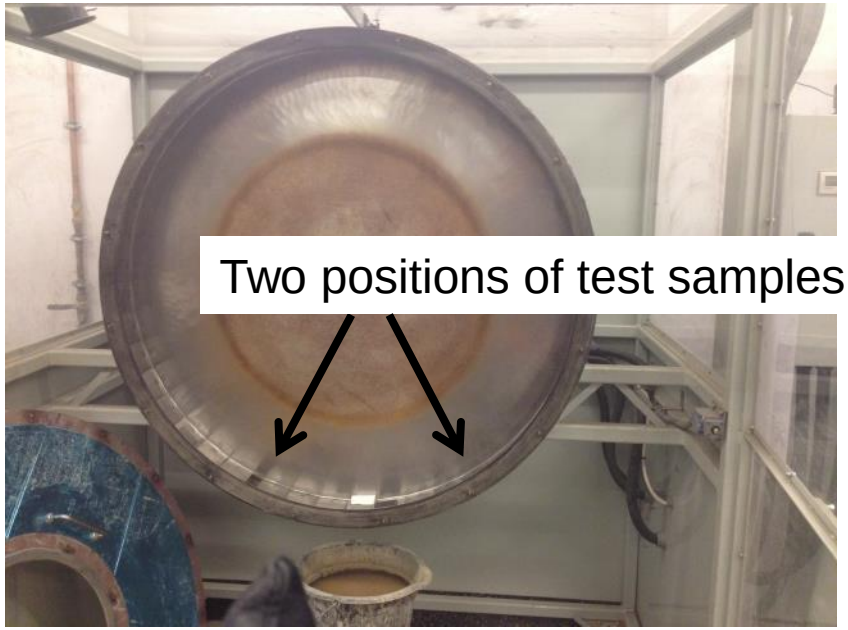
Ni-base layer

Metal

Project aim and content

- Aim: Examine non-stick properties of a steel on which a dual-layer of Ni-base metal and a non-stick material have been deposited.
  - 9 different non-stick materials will be examined
- Project plan includes:
  - Field exposures at two plants, Vesthamnsverket and Avedøre
  - Wear tests
  - Laboratory exposures
- Project partners:
  - MH Engineering (project leader)
  - Öresundskraft Kraft och Värme AB
  - Dong Energy Thermal Power A/S
  - Swerea KIMAB

Wear tests



- Samples are attached to the inner circumference of the test apparatus
- Exposure of maximum 48 samples simultaneously

Results, Material 4 (BN-silicate)

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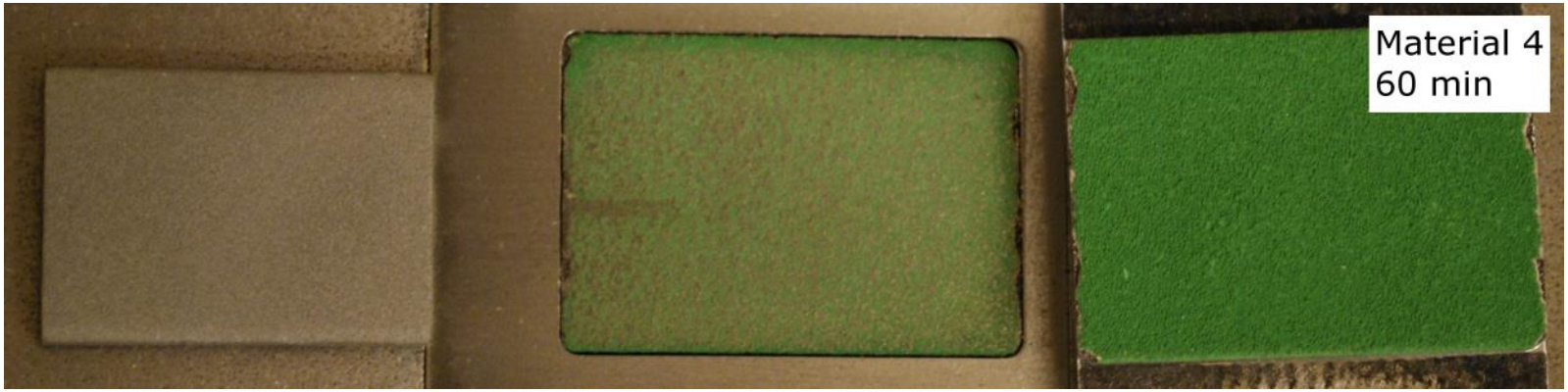

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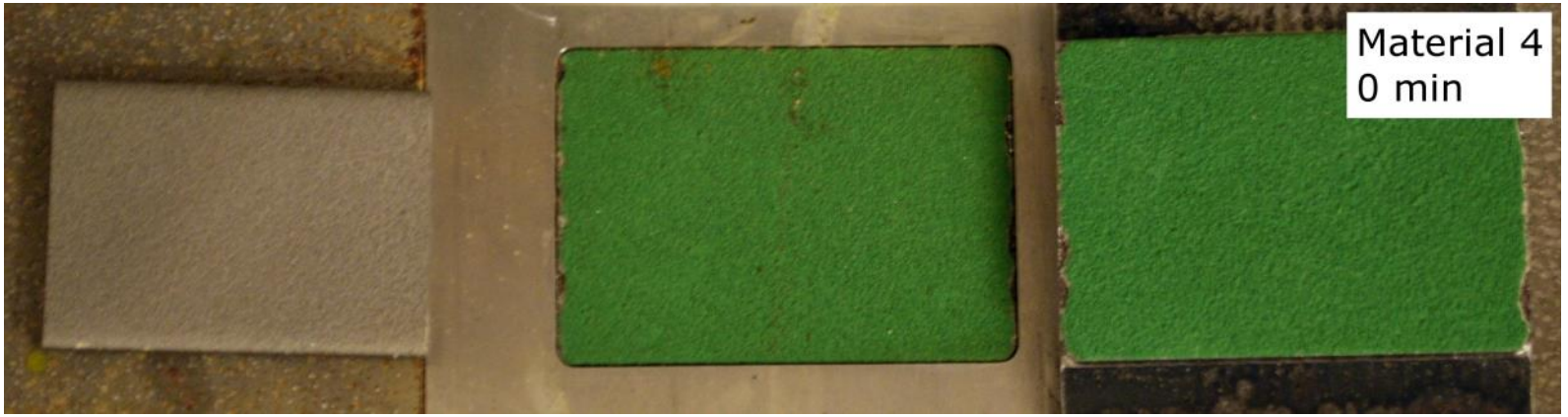
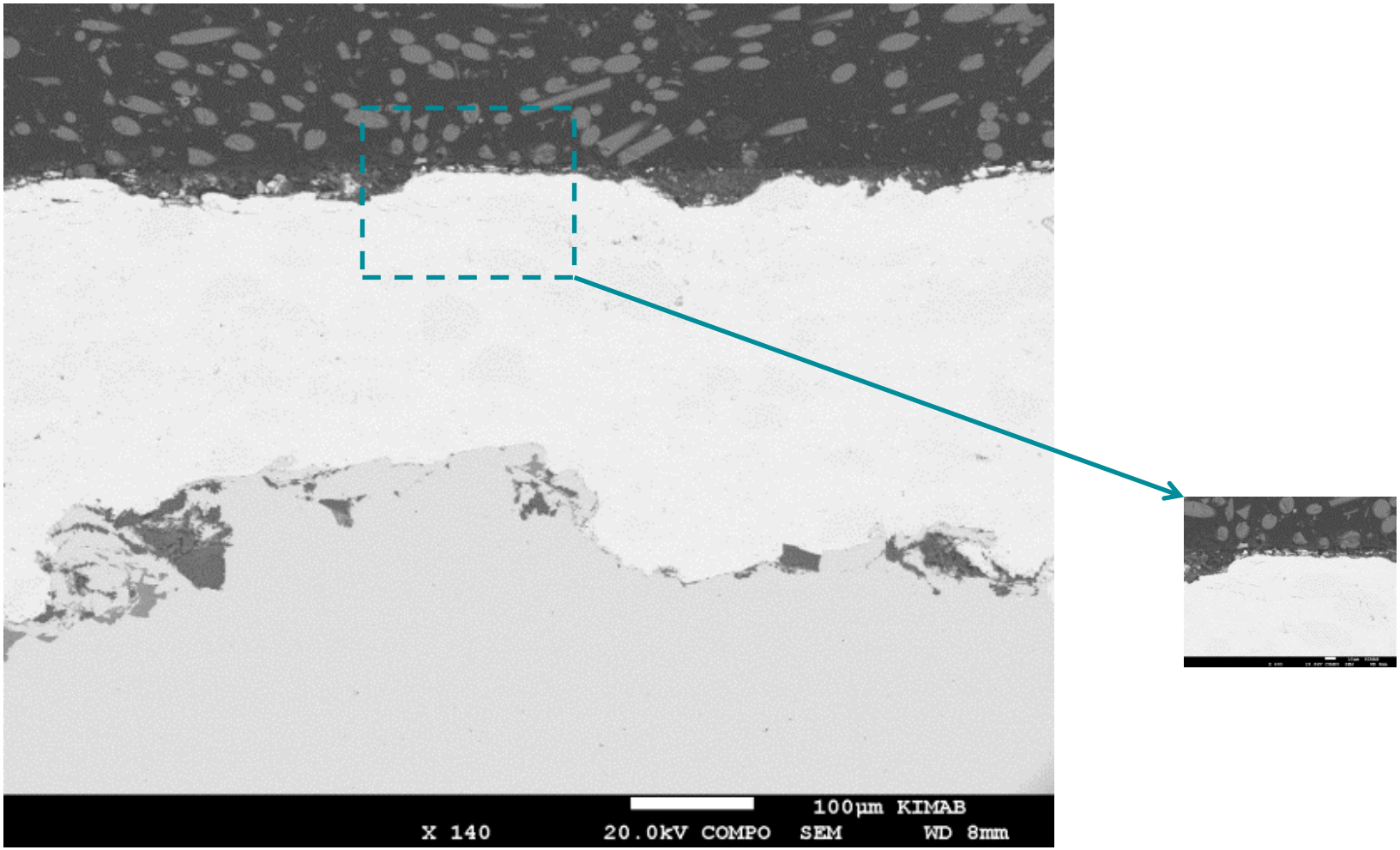


Results, Material 1 (PTFE), 600 min



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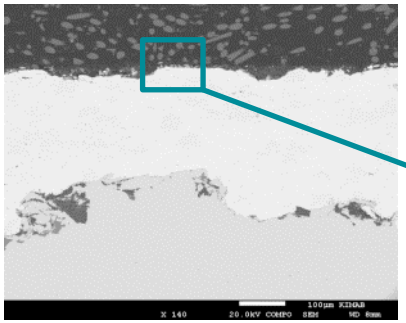

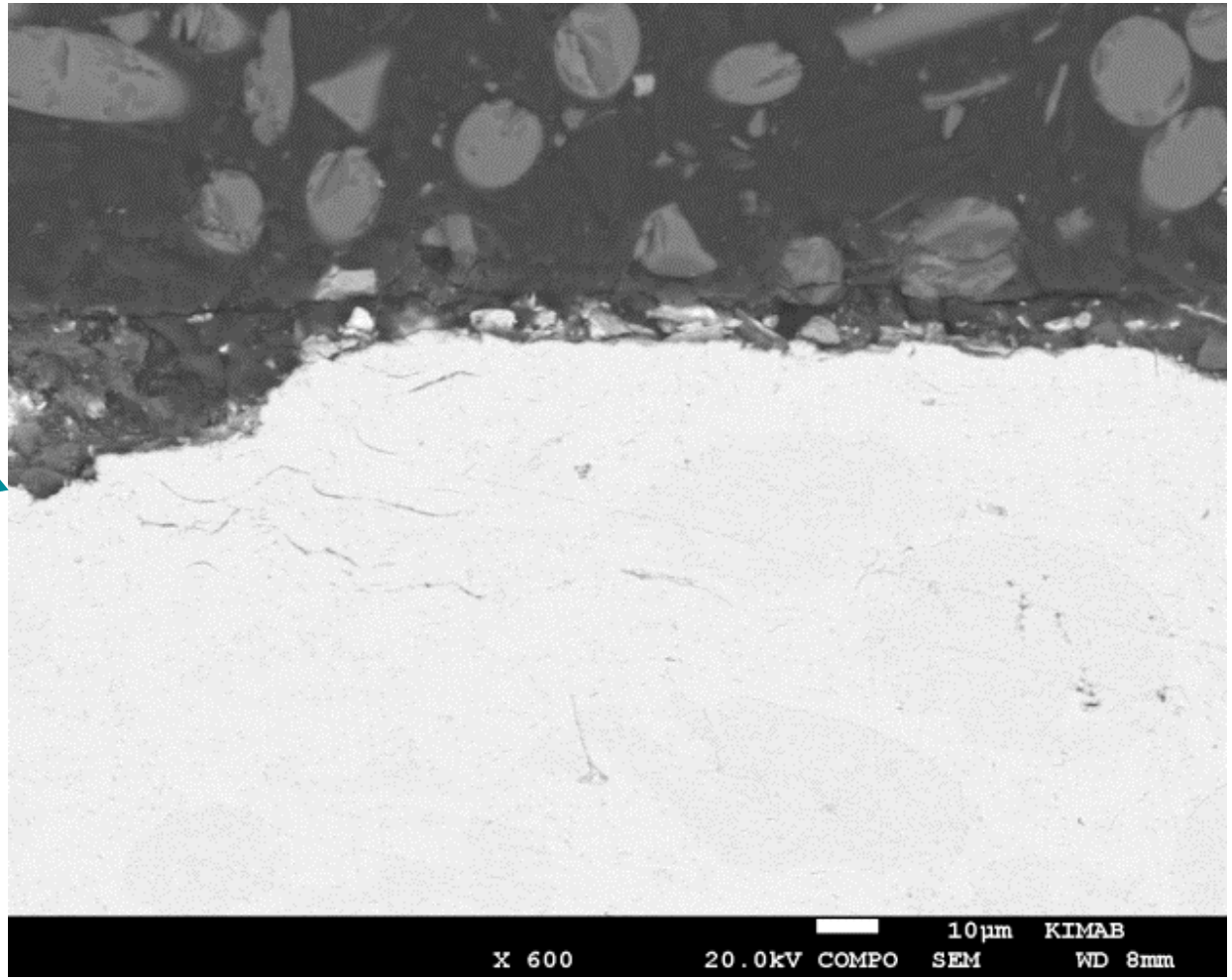

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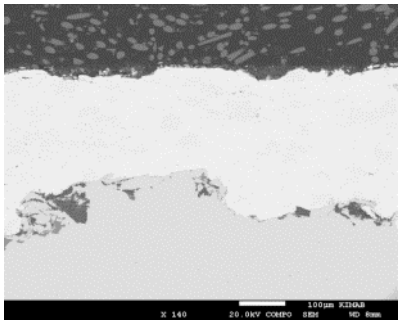
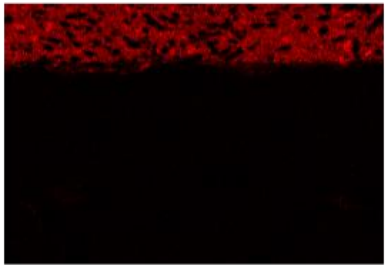
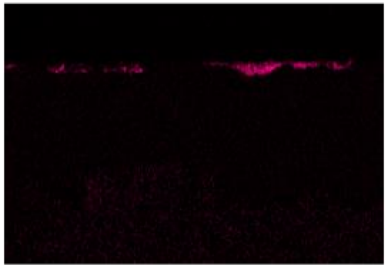


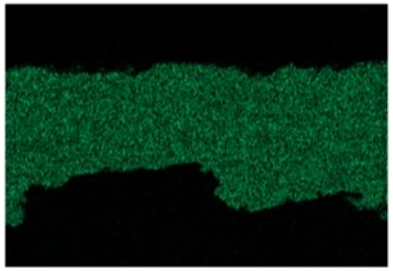
C K series



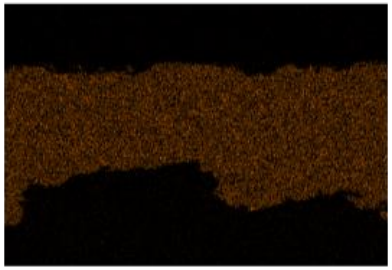
F K series



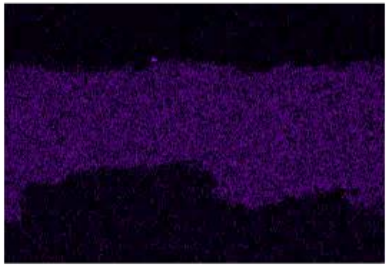
Ni K series



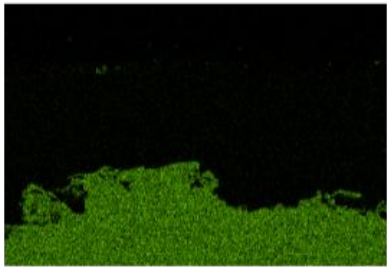
Cr K series



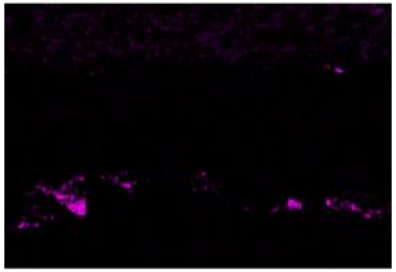
Mo L series



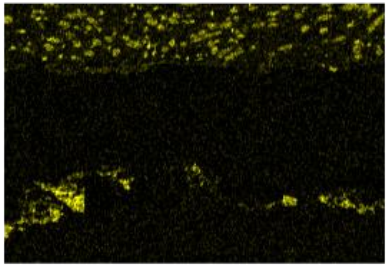
Fe K series



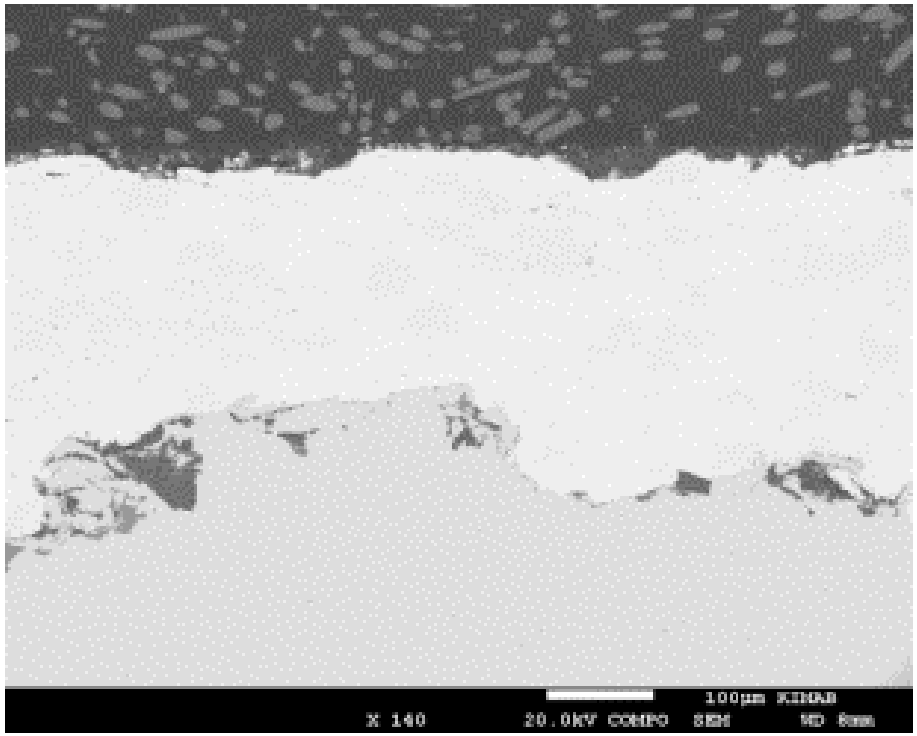
Al K series

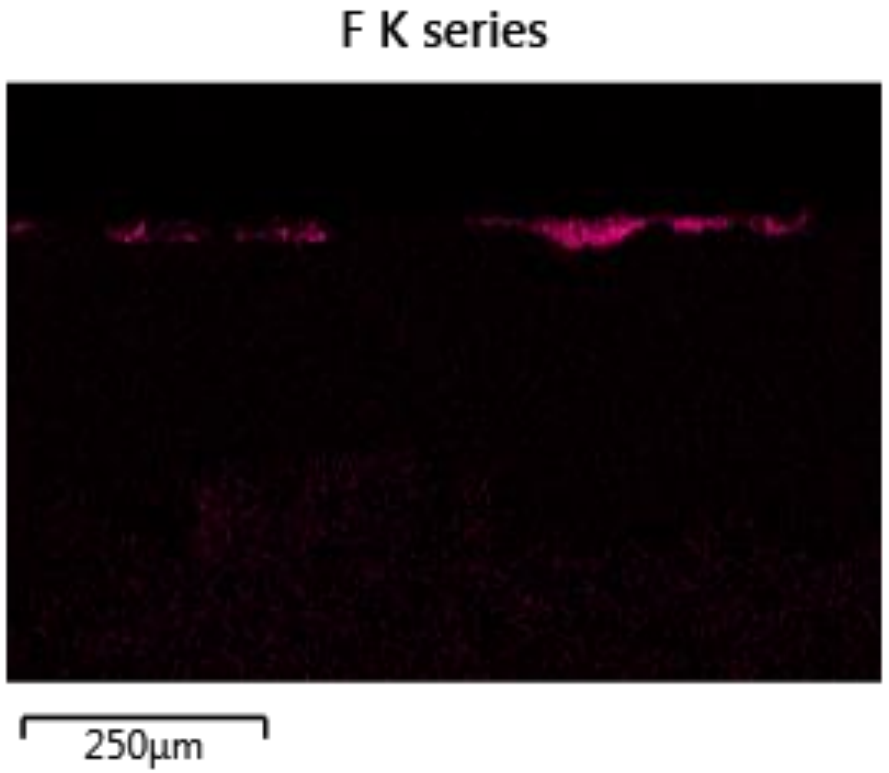


O K series



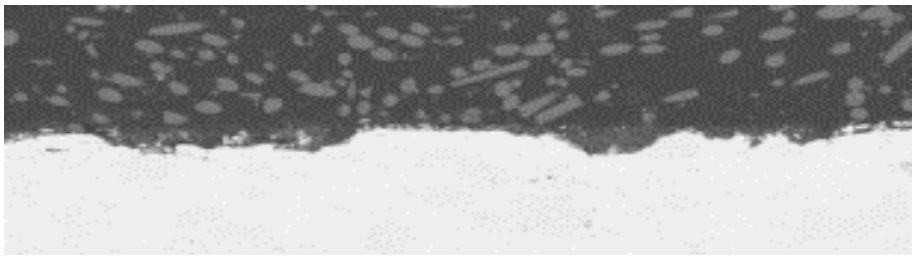
Results, Material 1 (PTFE), 600 min

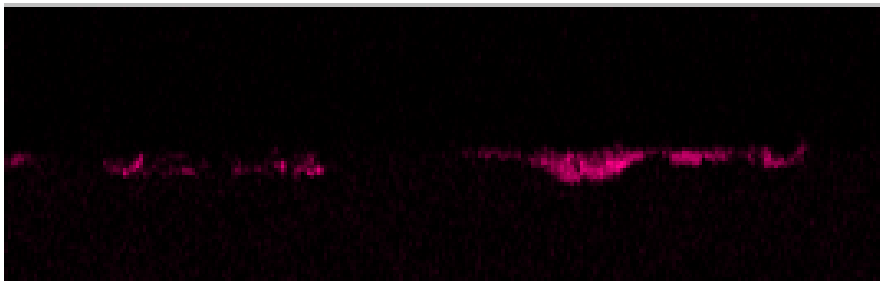


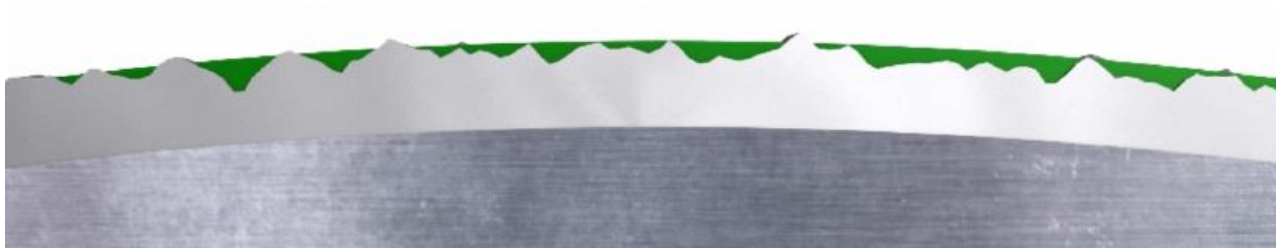


- PTFE still adherent after 10 h heavy wear test

Results, Material 1 (PTFE), 600 min

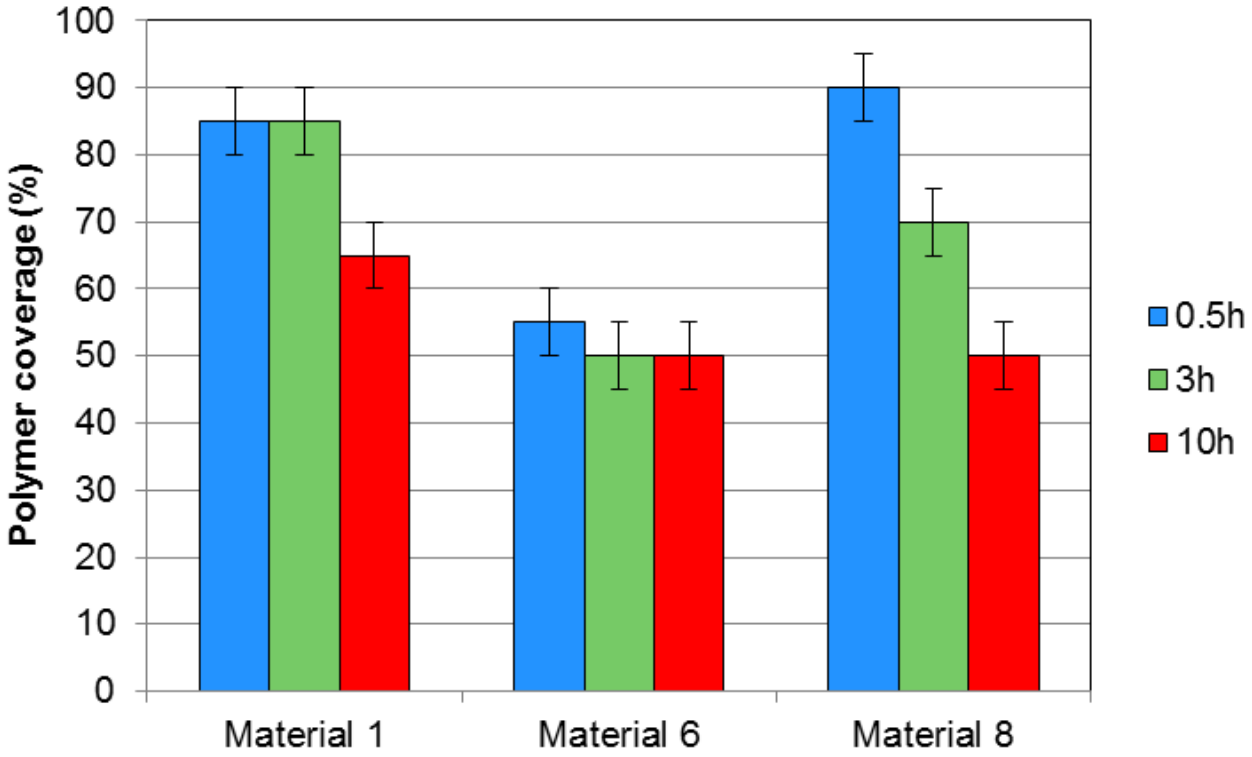






- Predicted and real wear behaviour almost identical

Results, Wear tests



- Material 1 – PTFE
- Material 6 – PTFE mix
- Material 8 – Silicone

Exposures in Vesthamnsverket

Material (No)	Type	Tmax (°C)	Furnace	SH-HT	SH-LT	Eco	ESP Cone
1	PTFE	250				X	X
2	Ceramic	400	X				X
3	No info	550			X		X
4	BN-silicate	?	X	X			
6	PTFE mix	250				X	X
7	No info	650			X		
8	Silicone	590			X		
9	BN	850	X	X			
10	Graphite based	1200	X	X			

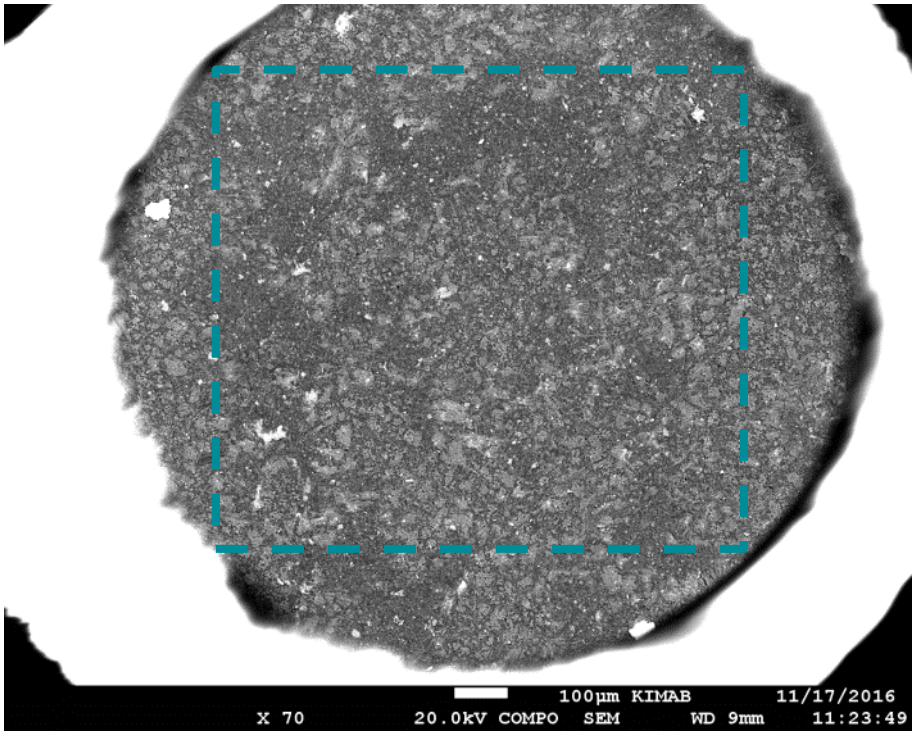
Exposures in Vesthamnsverket

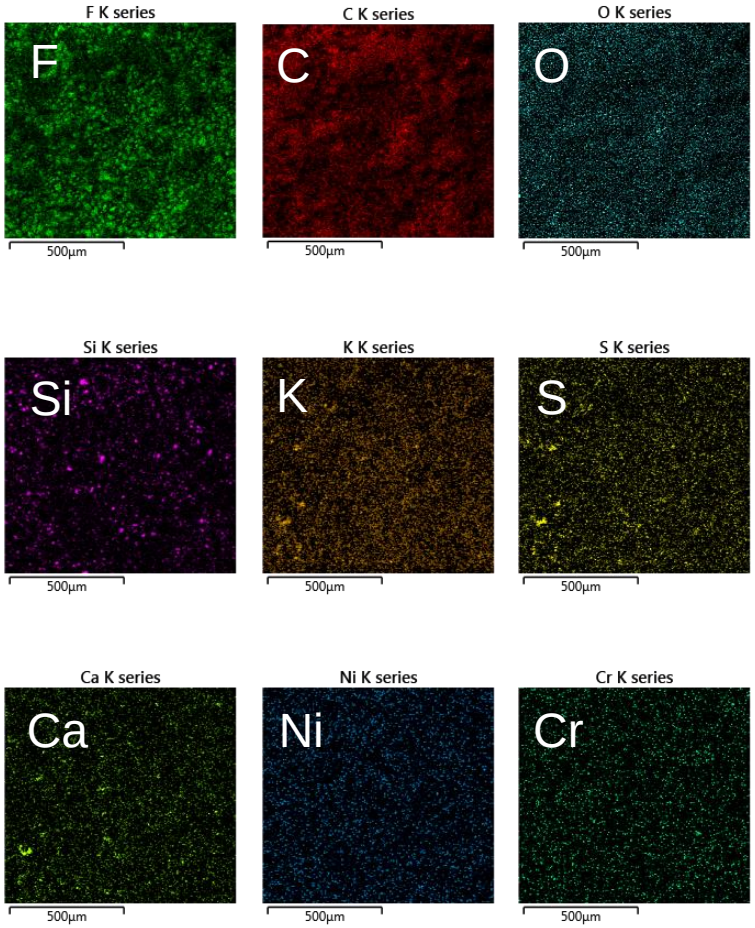
- Samples mounted in ESP after exposure for 1 firing season

Exposures in Vesthamnsverket

- Removed ESP samples after exposure for 1 firing season

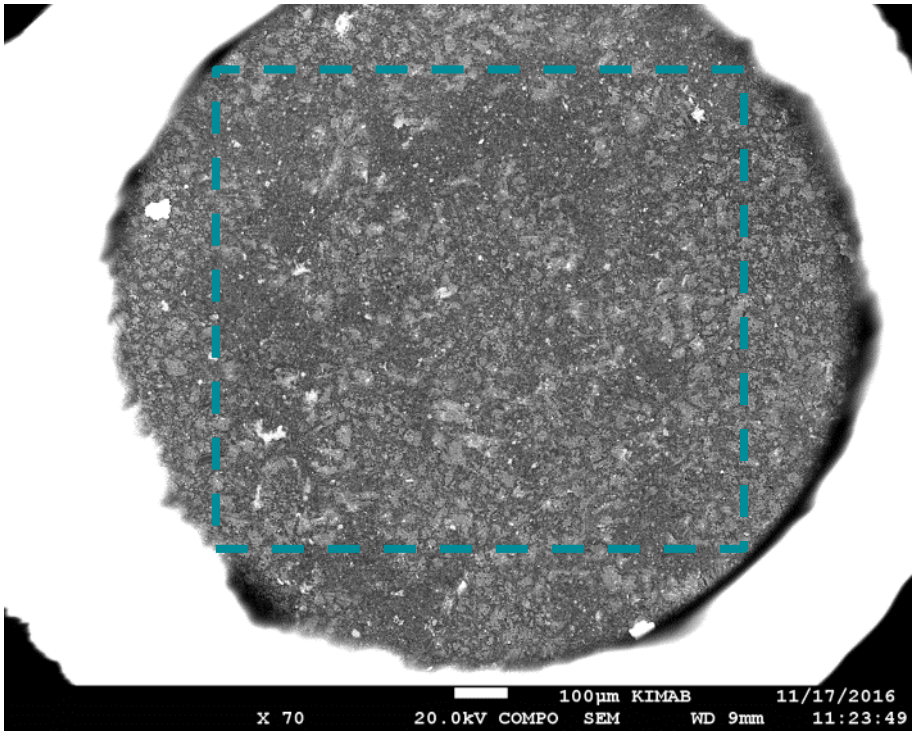
Exposures in Vesthamnsverket

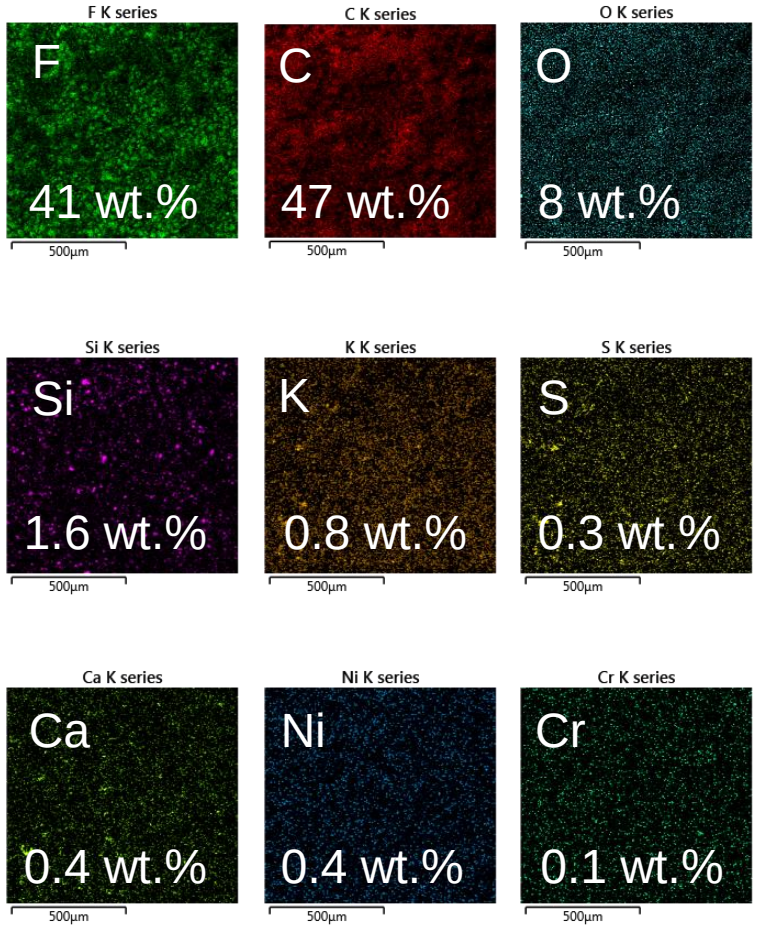




- ESP sample, Material 1 (PTFE), after exposure for 1 firing season, surface cleaned by brushing

Exposures in Vesthamnsverket





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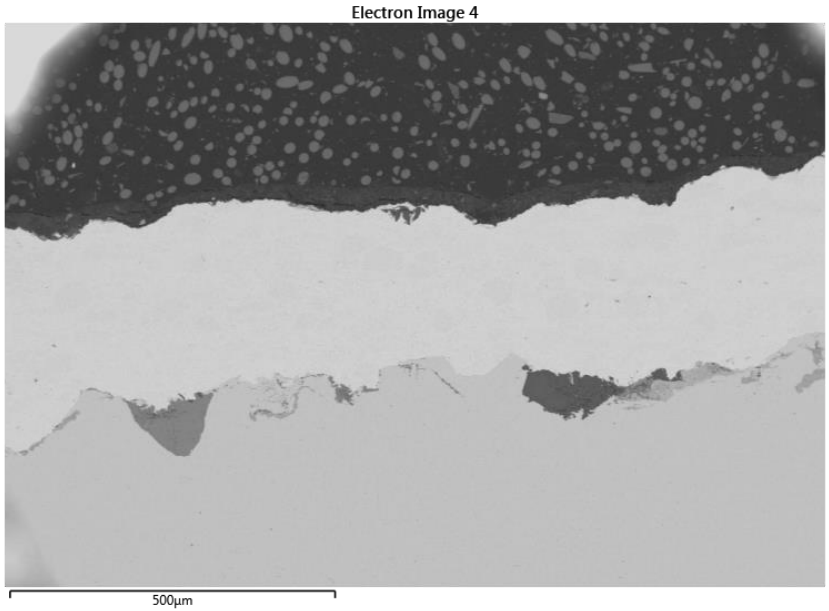
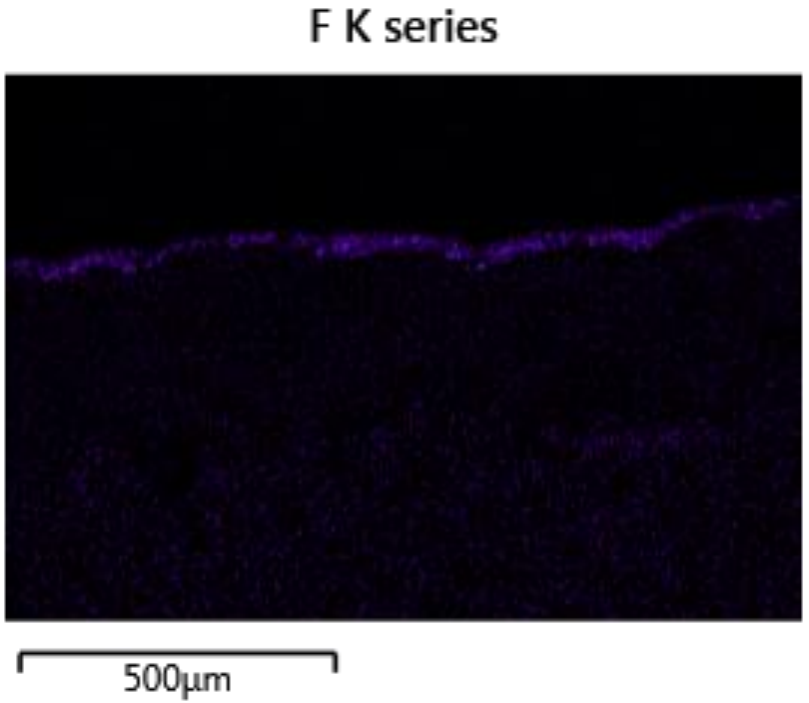
Exposures in Vesthamnsverket





- ESP sample, Material 1 (PTFE), after exposure for 1 firing season

Preliminary conclusions

- The Composite Metal Polymer (CMP) coating system remains functional after heavy wear testing at room temperature
- The Composite Metal Polymer (CMP) coating system can remain intact after 1 firing season of field exposure at some plant positions
- Composite Metal Polymer (CMP) coatings have demonstrated their great potential to be used for non-stick improvements in CHP plants

Thank you for your attention!

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