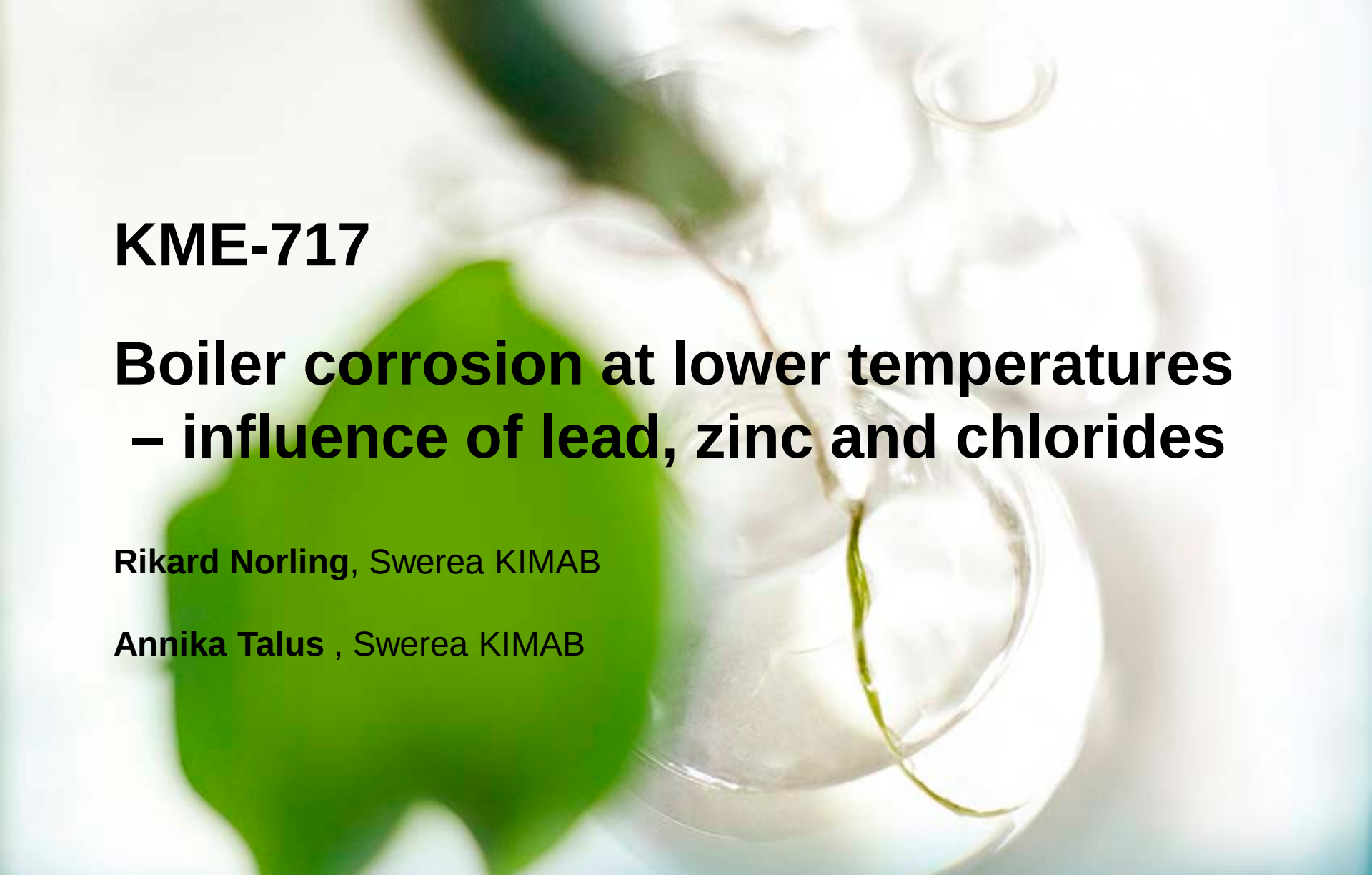




KME-717

Boiler corrosion at lower temperatures – influence of lead, zinc and chlorides

Rikard Norling, Swerea KIMAB

Annika Talus , Swerea KIMAB

KME-717

Boiler corrosion at lower temperatures – influence of lead, zinc and chlorides

Rikard Norling, Annika Talus



Annika Stålenheim
Pamela Henderson
Mattias Mattsson



Christoph Gruber



Eva-Katrin Lindman



Patrik Yrjas
Dorota Bankiewicz

Project goals

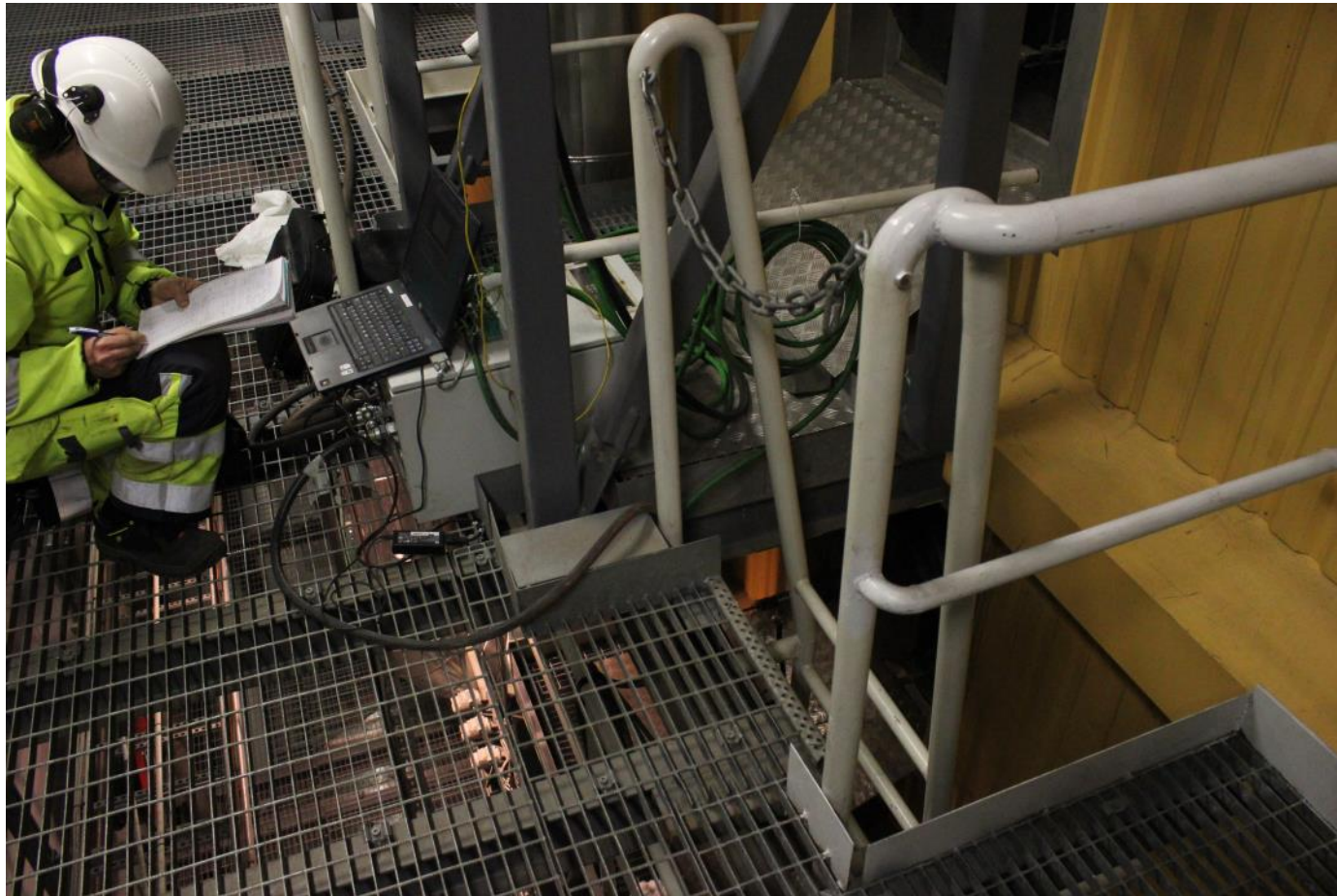
- To find out if lead, zinc and their chlorides causes serious corrosion problems in the temperature range 150-420°C in boilers firing used wood,
 - o and if the attack is worsened by the use of additive that reduce alkali chloride corrosion on superheaters at higher temperatures.
- Based on the knowledge acquired by full-scale probe testing and the results of modelling and laboratory testing solutions for minimizing potential problems will be suggested.
- To investigate and describe the ongoing corrosion processes and make an attempt to explain the mechanisms behind them to some extent.

Jordbro P7

- BFB boiler
- Commissioned 2010
- 63 MW_{th}, 20 MW_{el}
- Steam data: 80 bar, 470°C
- Fuel 100% recycled (waste) wood
- ChlorOut (system with ammonium sulphate additive)



Field testing



Field testing

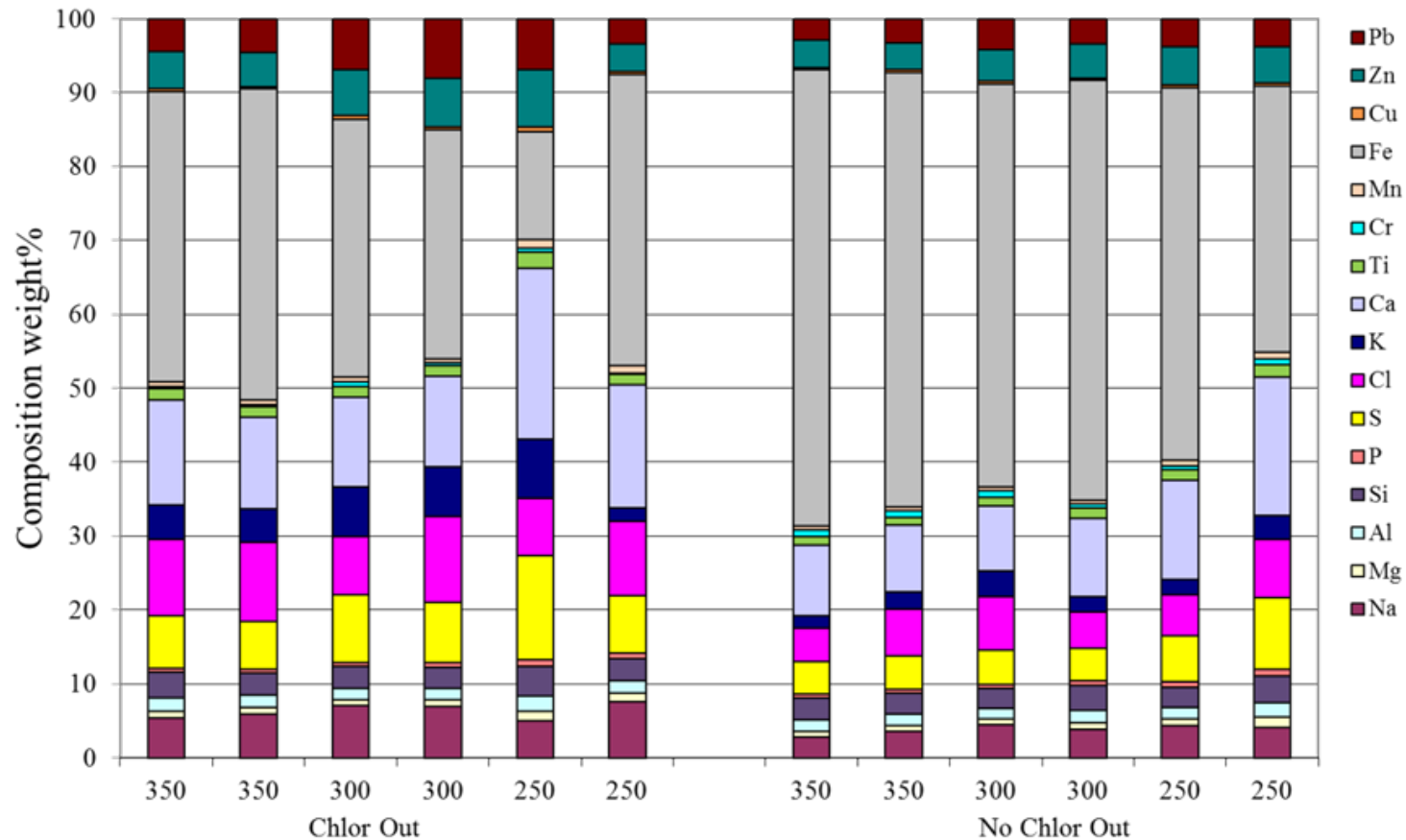


Selection of deposit probe results

T		#1		#2	
(°C)		Wind	Lee	Wind	Lee
350	Chlor Out				
300					
250					
350	No Chlor Out				
300					
250					

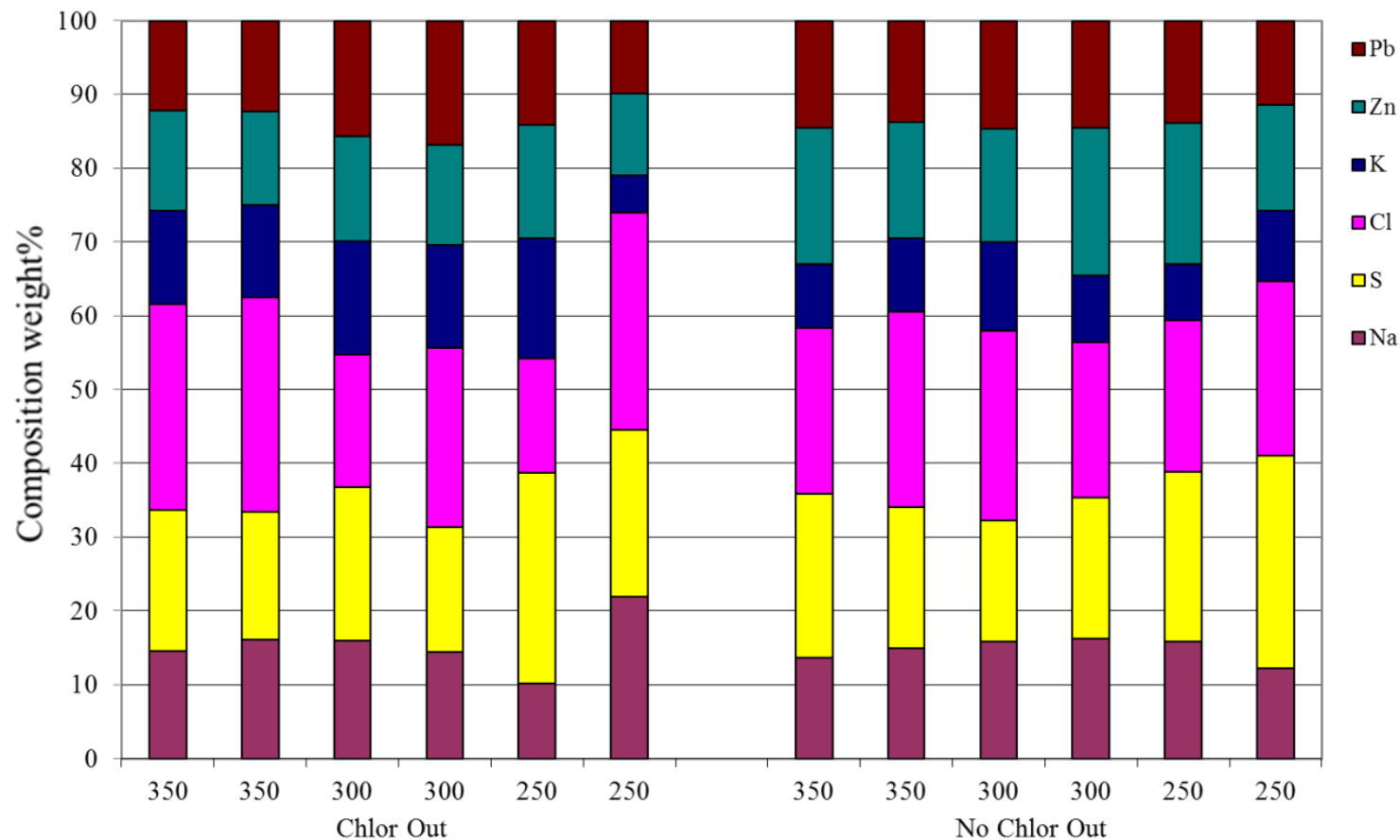
- 3 h test, with and without ChlorOut in operation

Selection of deposit probe results



- 3 h test, with and without ChlorOut in operation

Selection of deposit probe results



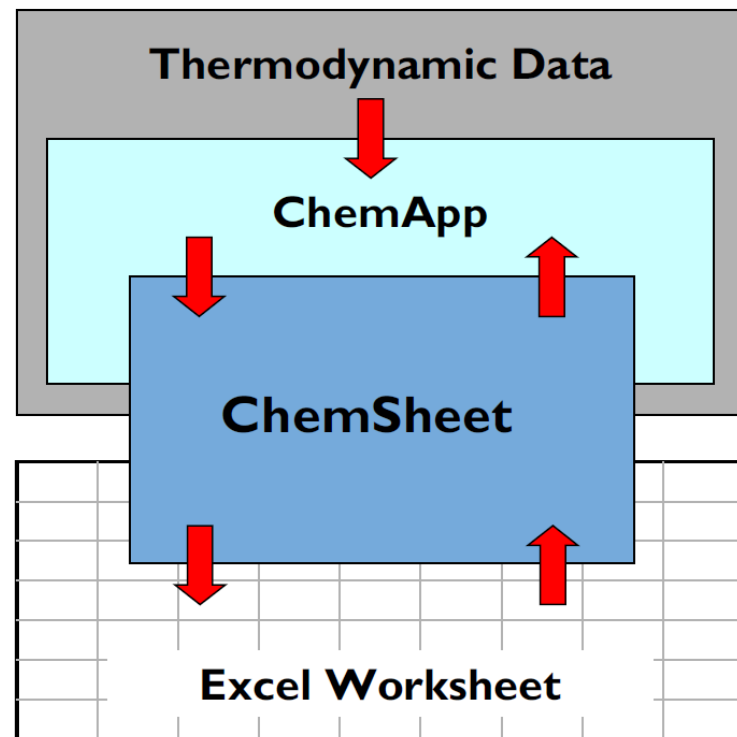
- 3 h test
- Results normalised with respect to key elements only

Corrosion probe testing

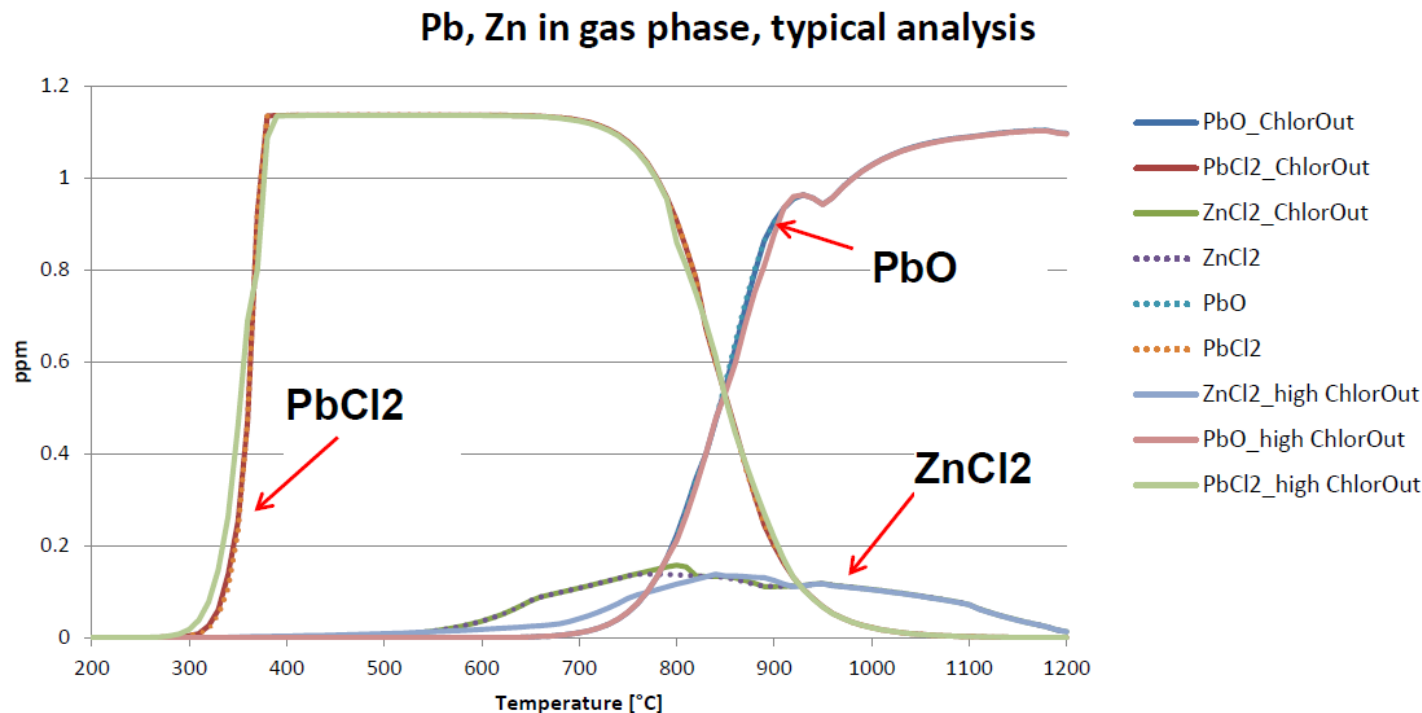
- Long term corrosion testing recently finished
 - 1000 h
 - With ChlorOut
- Results from investigation of the samples soon to come

Chemsheet calculations by Andritz

- **Chemsheet** works as an add-in program of general thermodynamics in **Excel**.
- The thermochemical programming library **ChemApp** is used in combination with its application-specific thermochemical data
- ChemSheet is straightforward and requires no programming skills other than normal Excel use
- To the user, the process model can be just one Excel-file
- Andritz has a tailor-made database from Åbo Akademi University (“Andritz Melt”)

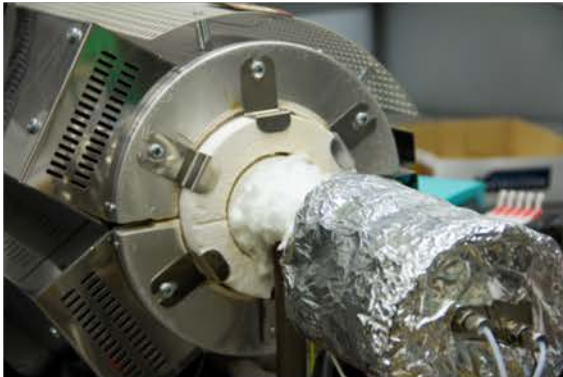


Chemsheet calculations by Andritz

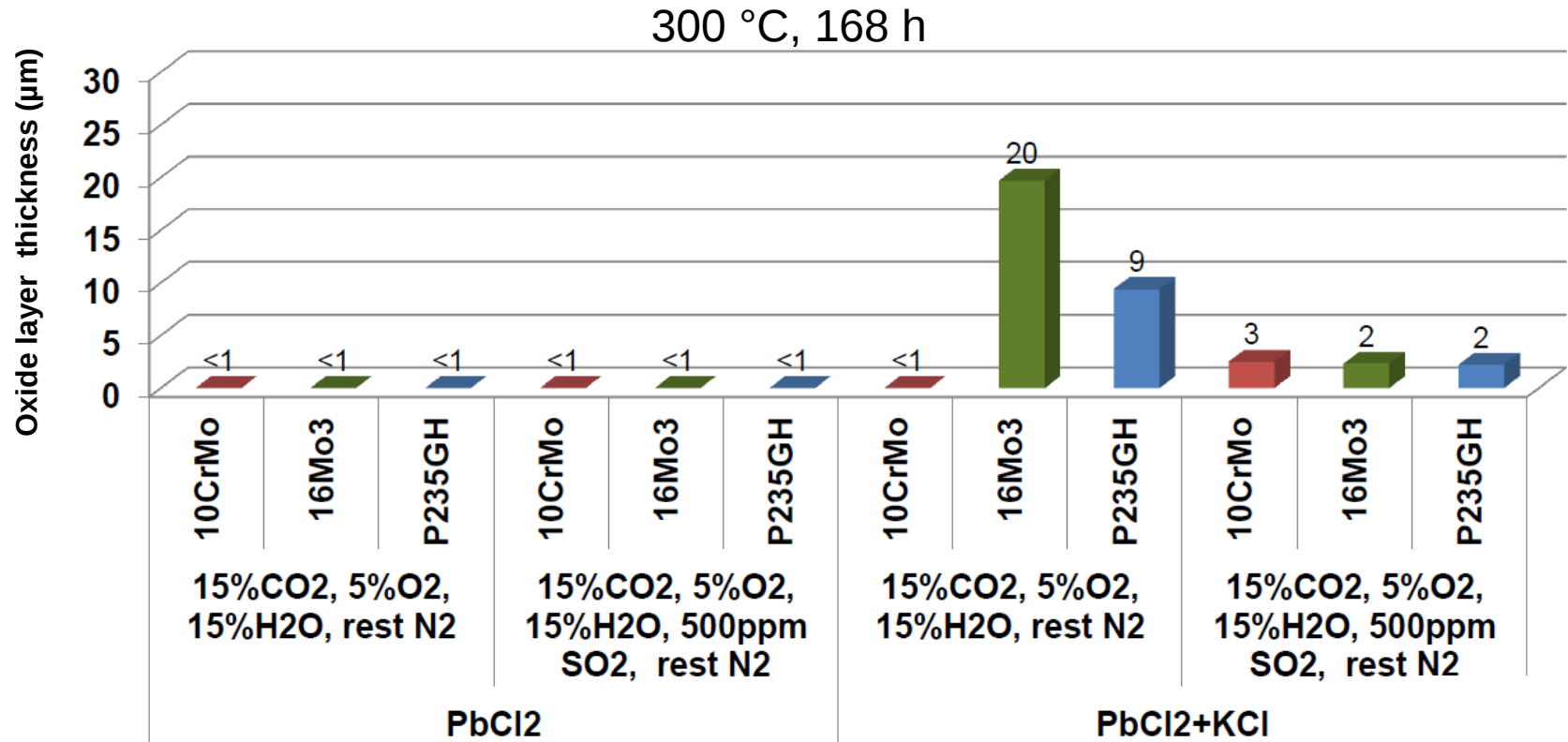


- Pb and Zn composition in gas phase similar, with and without ChlorOut

Isothermal corrosion tests at Åbo Akademi University



Isothermal corrosion tests at Åbo Akademi University

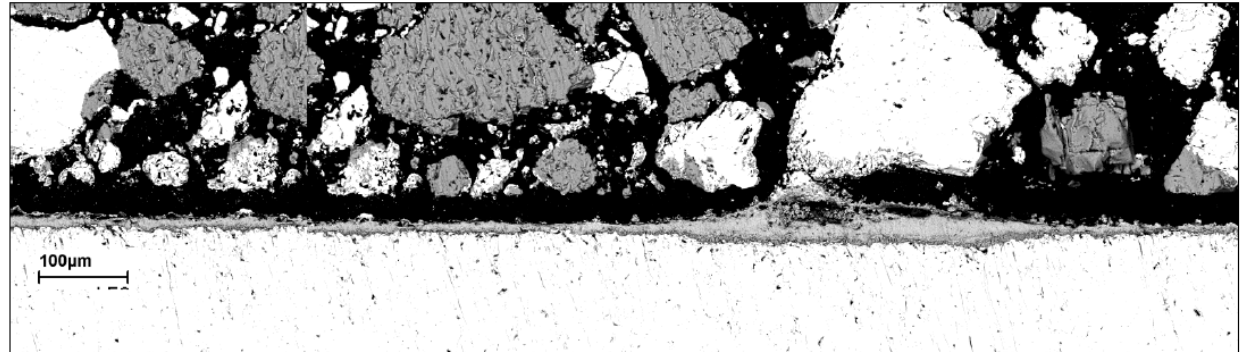


- Corrosion only in presence of mixed salt
- Corrosion decreases with SO₂ present

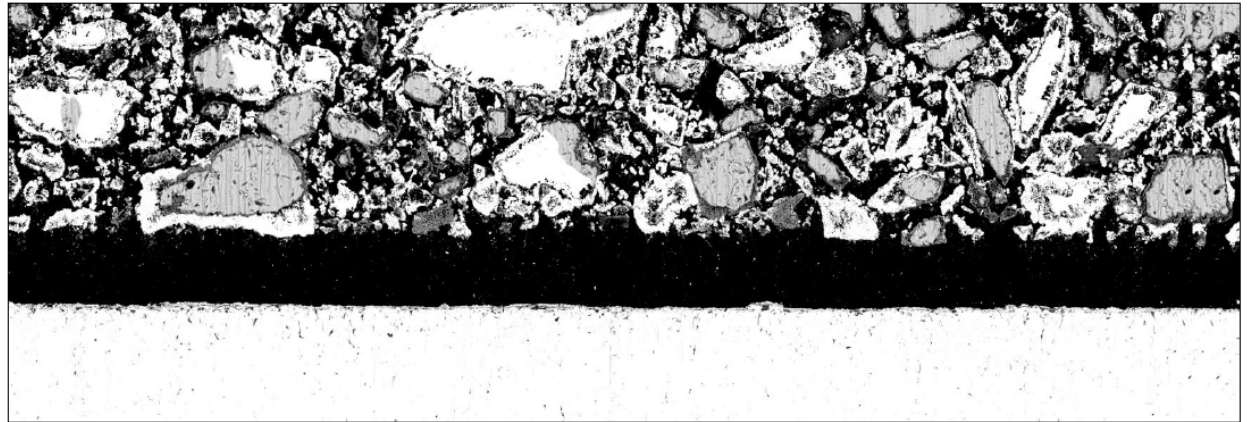
Isothermal corrosion tests at Åbo Akademi University

300 °C, 168 h

16Mo3 exposed with PbCl_2/KCl mixture in Gas 2 no SO_2)



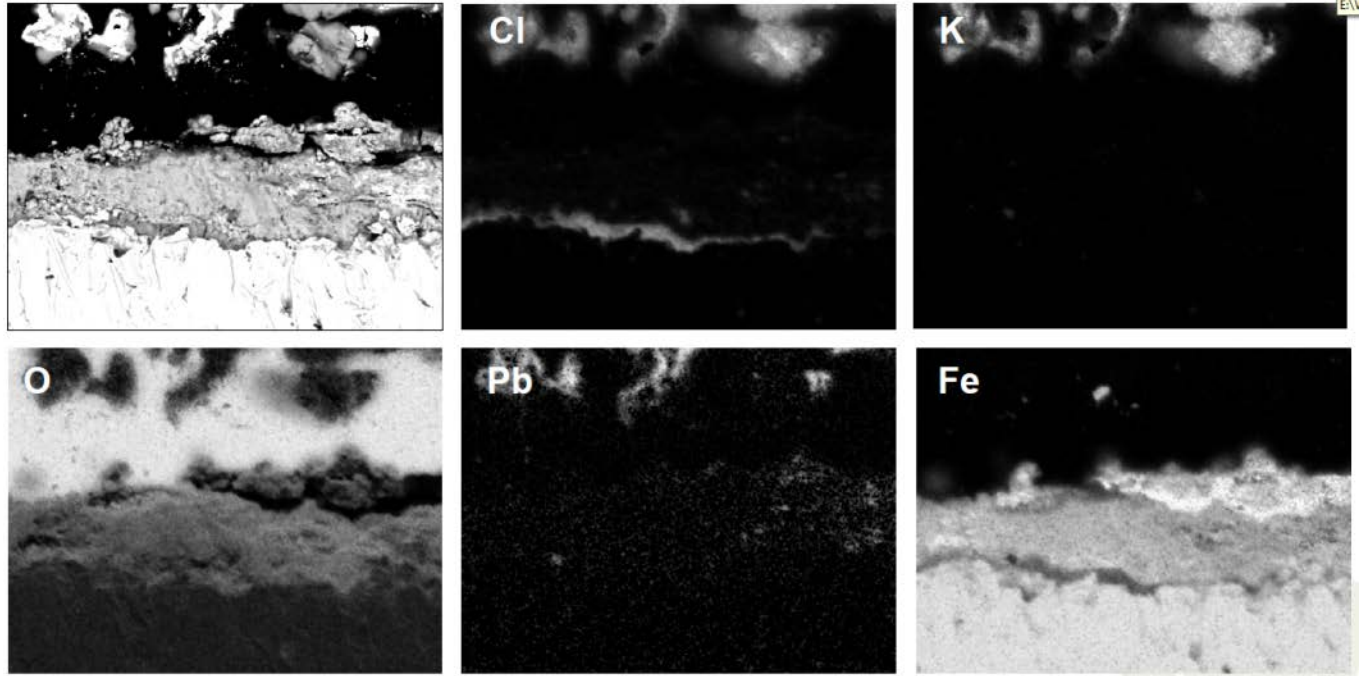
16Mo3 exposed with PbCl_2/KCl mixture in Gas 1 with 500 ppm SO_2)



Isothermal corrosion tests at Åbo Akademi University

300 °C, 168 h

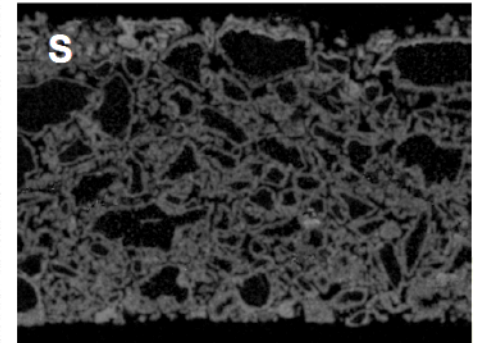
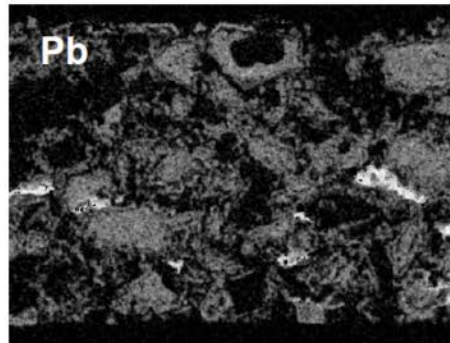
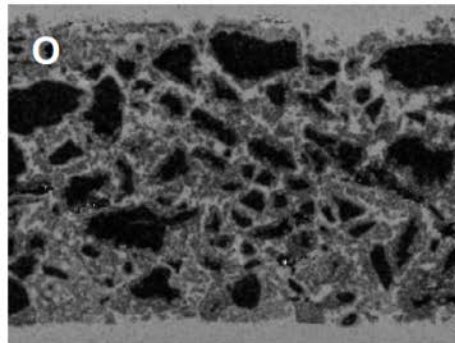
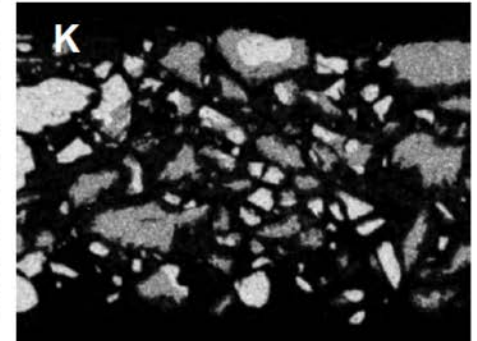
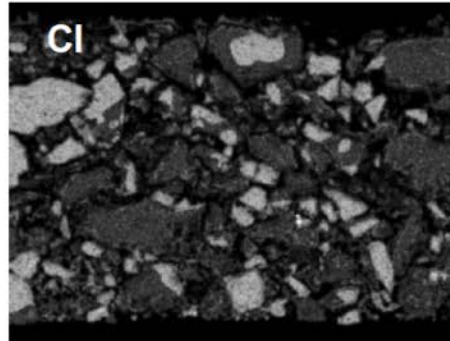
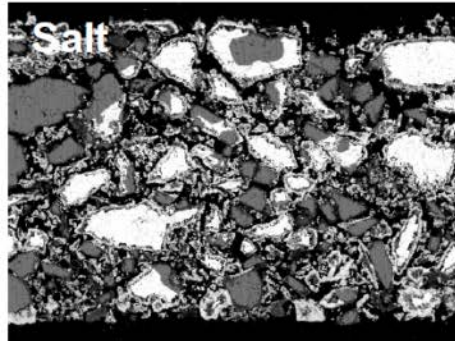
16Mo3 exposed with PbCl_2/KCl salt mixture in Gas 2 without SO_2)



Isothermal corrosion tests at Åbo Akademi University

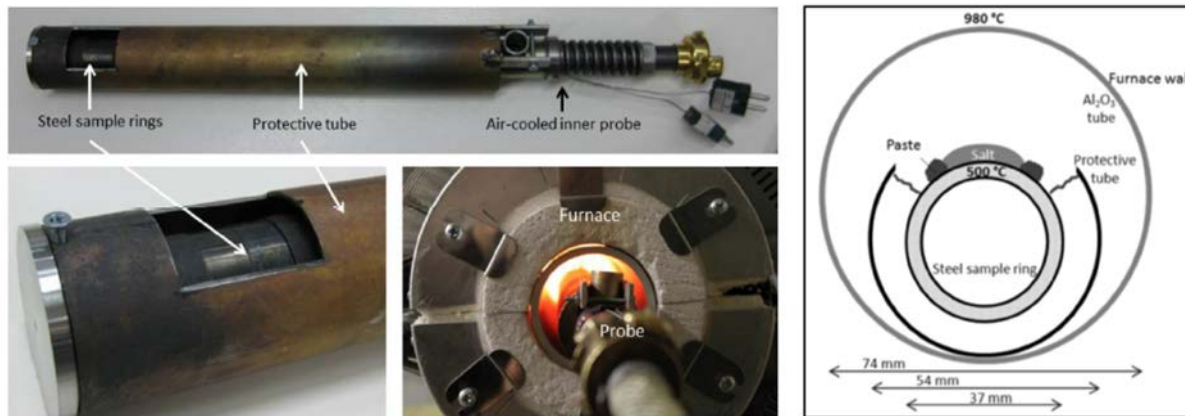
300 °C, 168 h

PbCl₂/KCl salt mixture exposed in Gas 1 with 500 ppm SO₂)



Testing of temperature gradient effect on salt and corrosion at Åbo Akademi University

- Steep temperature gradient over superheater and deposit (surface => gas)
- Laboratory simulations



Conclusions

- Deposit tests and calculations suggest that use of ChlorOut will not give a major negative impact on the corrosivity of deposits
- Laboratory corrosion tests suggest that presence of SO₂ in the gas will have a positive influence on the corrosion attack



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