

RDF-LIGNITE CO-COMBUSTION IN A CFB BOILER



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CO-COMBUSTION OF LIGNITE AND RDF IN A CFB BOILER

48th IEA-FBC Meeting / Wien / 24.5.2004



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CONTENT OF THE PRESENTATION

- Description of the test equipment
- Analyses of the feedstock
- Course of the test runs
- Basic process parameters
- Probe tests
 - Fouling rate (corrosion)
- Comparison of the results to other plants
- Summary

TEST ARRANGEMENT - POWER PLANT

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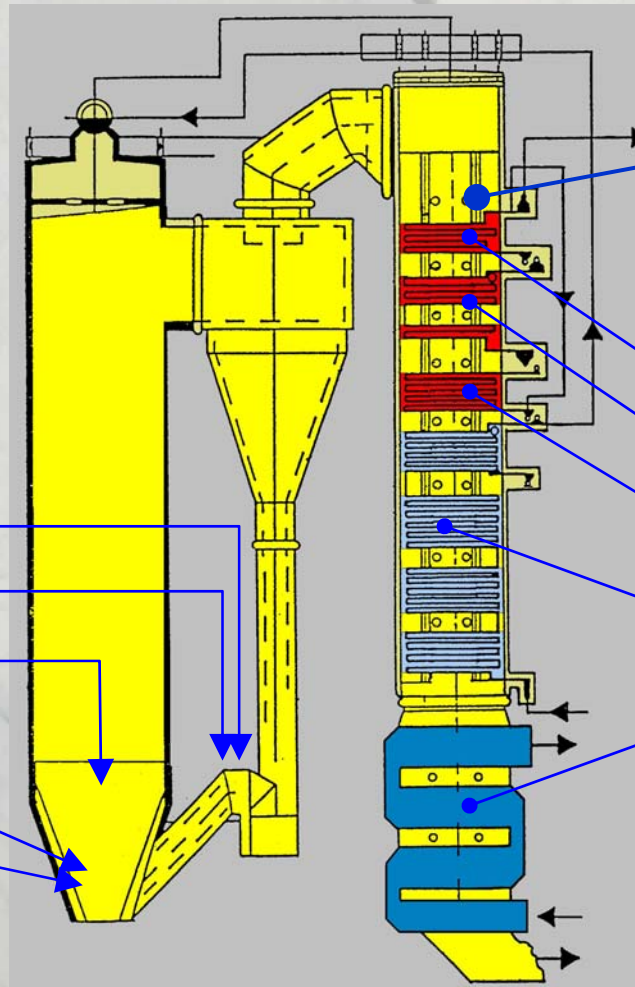
LIGNITE FIRING CFB

Steam data :

- 77.8 kg/s
- 510 °C
- 90 bar

Fuels :

- Lignite
- Sewage sludge
- Lignite sludge
- (Demolition wood)
- RDF



PROBE
LOCATION

SUPERHEATER 4

SUPERHEATER 3

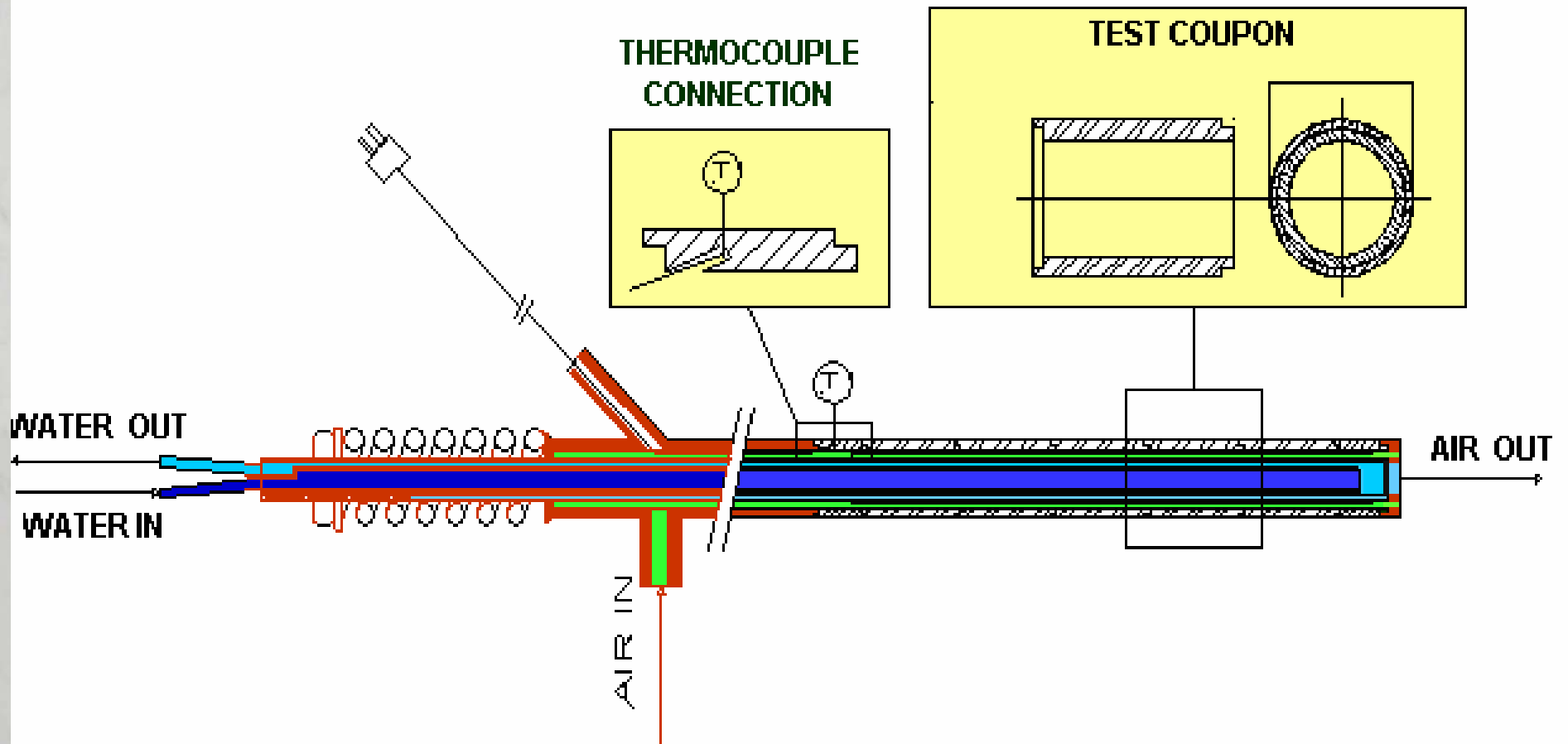
SUPERHEATER 2

ECONOMIZER

AIR PREHEATER

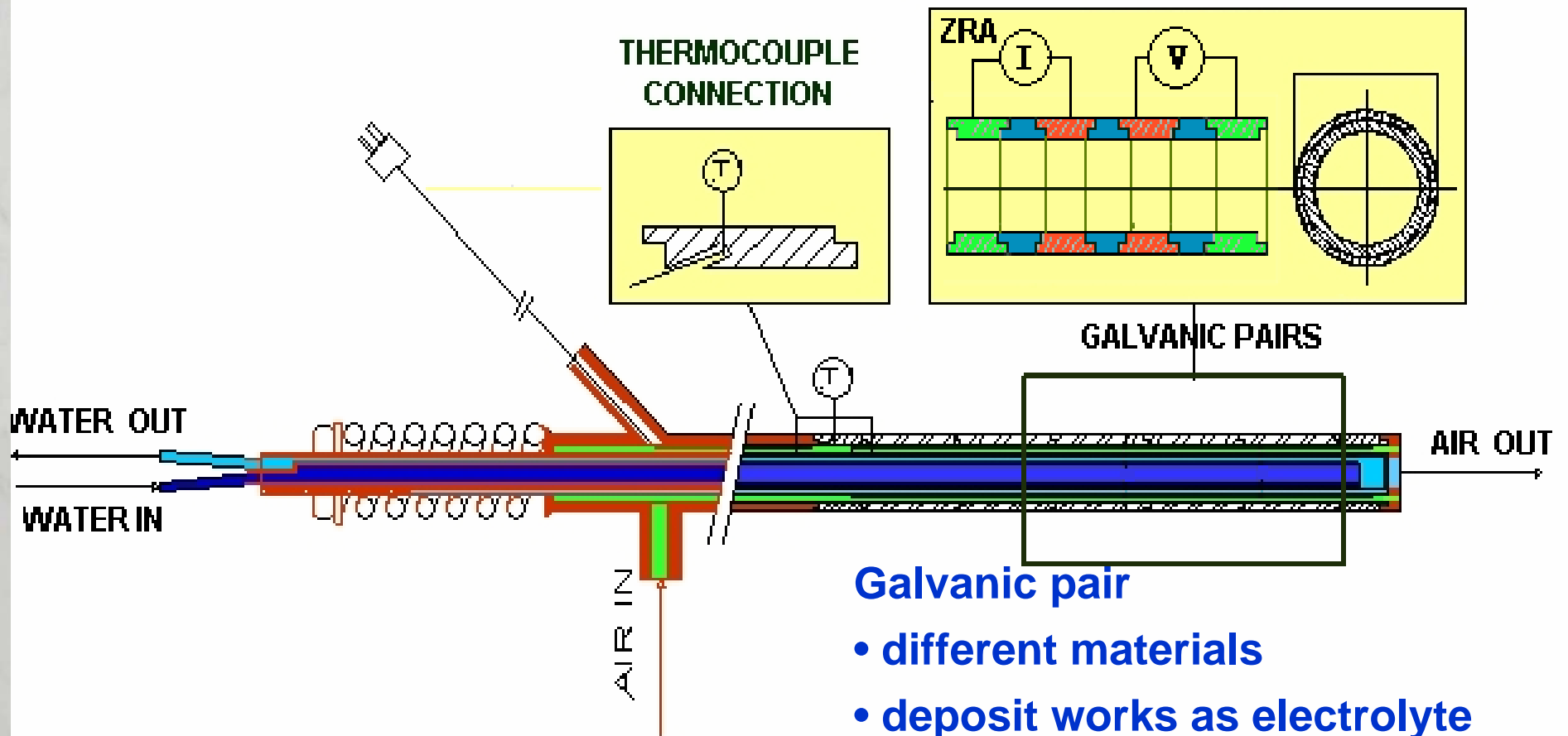
TEST ARRANGEMENT - DEPOSIT PROBE

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TEST ARRANGEMENT - ELECTROCHEMICAL PROBE

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FUEL ANALYSIS

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		LIGNITE	SLUDGE	RDF
Moisture	%	52	73	28
Ash	% (in d.s.)	4.3	48	13
Heat value	MJ/kg (a.r.)	10.3	1.0	14.8
Carbon (C)	% (in d.s.)	65.0	24.7	50.3
Hydrogen (H)	% (in d.s.)	4.7	3.7	7.0
Nitrogen (N)	% (in d.s.)	0.84	3.3	0.98
Sulfur (S)	% (in d.s.)	0.37	1.5	0.17
Chlorine (Cl)	mg/kg (in d.s.)	<100	900	6300
Sodium (Na)	mg/kg (in d.s.)	1700	6500	3600
Potassium (K)	mg/kg (in d.s.)	200	5400	3300
Lead (Pb)	mg/kg (in d.s.)	0.5	200	150
Cadmium (Cd)	mg/kg (in d.s.)	<1	4	3
Chrome (Cr)	mg/kg (in d.s.)	2	60	75
Copper (Cu)	mg/kg (in d.s.)	1	400	450
Mercury (Hg)	mg/kg (in d.s.)	0.1	2.1	0.2



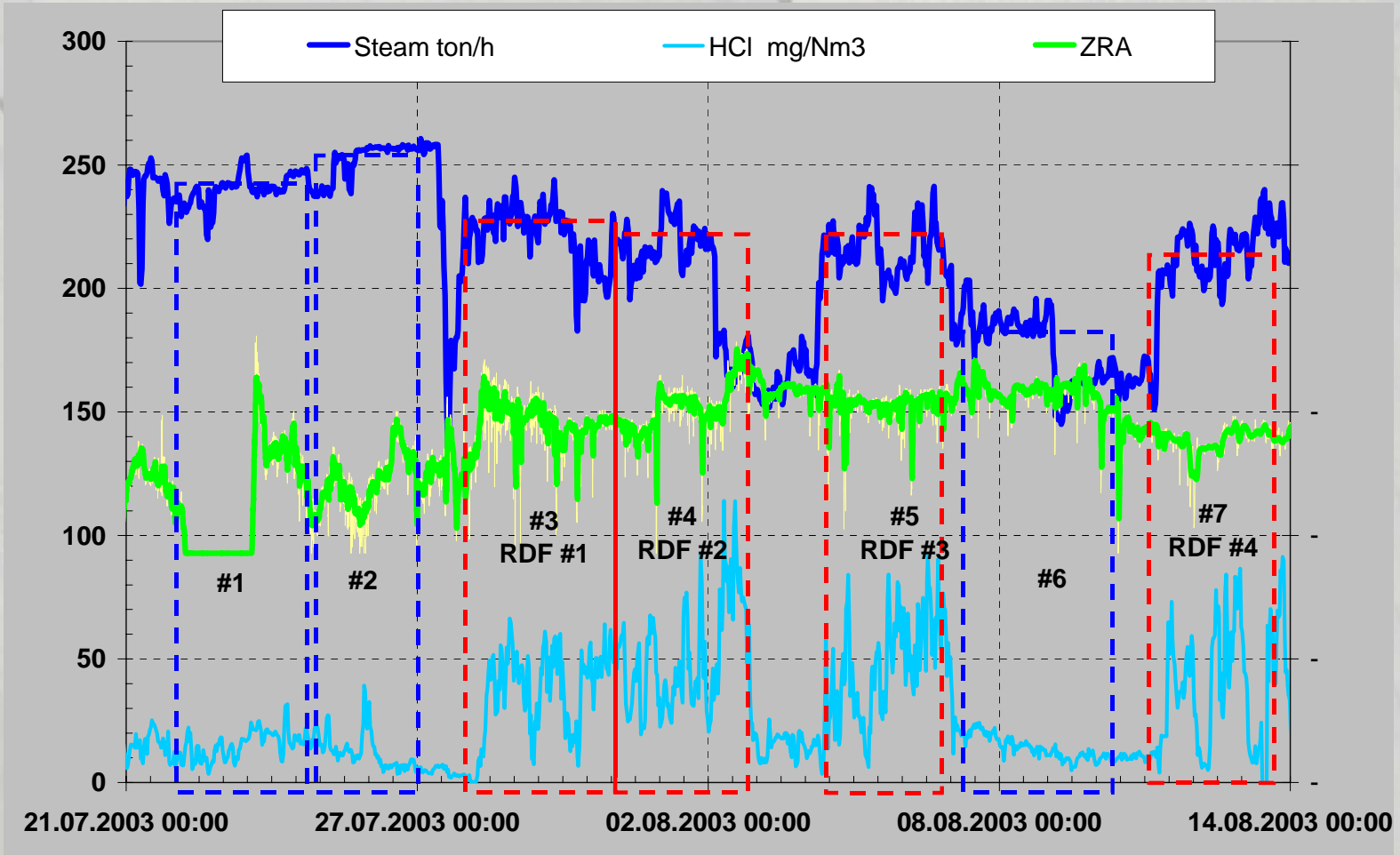
TEST PROGRAM

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Test	Fuel mix	Duration	Load	RDF	RDF	Sludge	Coal
		Hours	%	% (heat)	% (mass)	% (mass)	% (mass)
#1	lignite+sludge	66	86	-	-	25	75
#2	lignite+sludge	56	89	-	-	20	80
#3	lignite+sludge+RDF	62	80	10	6	25	69
#4	lignite+sludge+ RDF	66	74	13	7	30	63
#5	lignite+sludge+ RDF	60	77	13	7	28	65
#6	lignite	70	63	-	-	-	100
#7	lignite+sludge+ RDF	58	78	11	6	23	71

OPERATION DURING THE TESTS

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MAIN PROCESS PARAMETERS

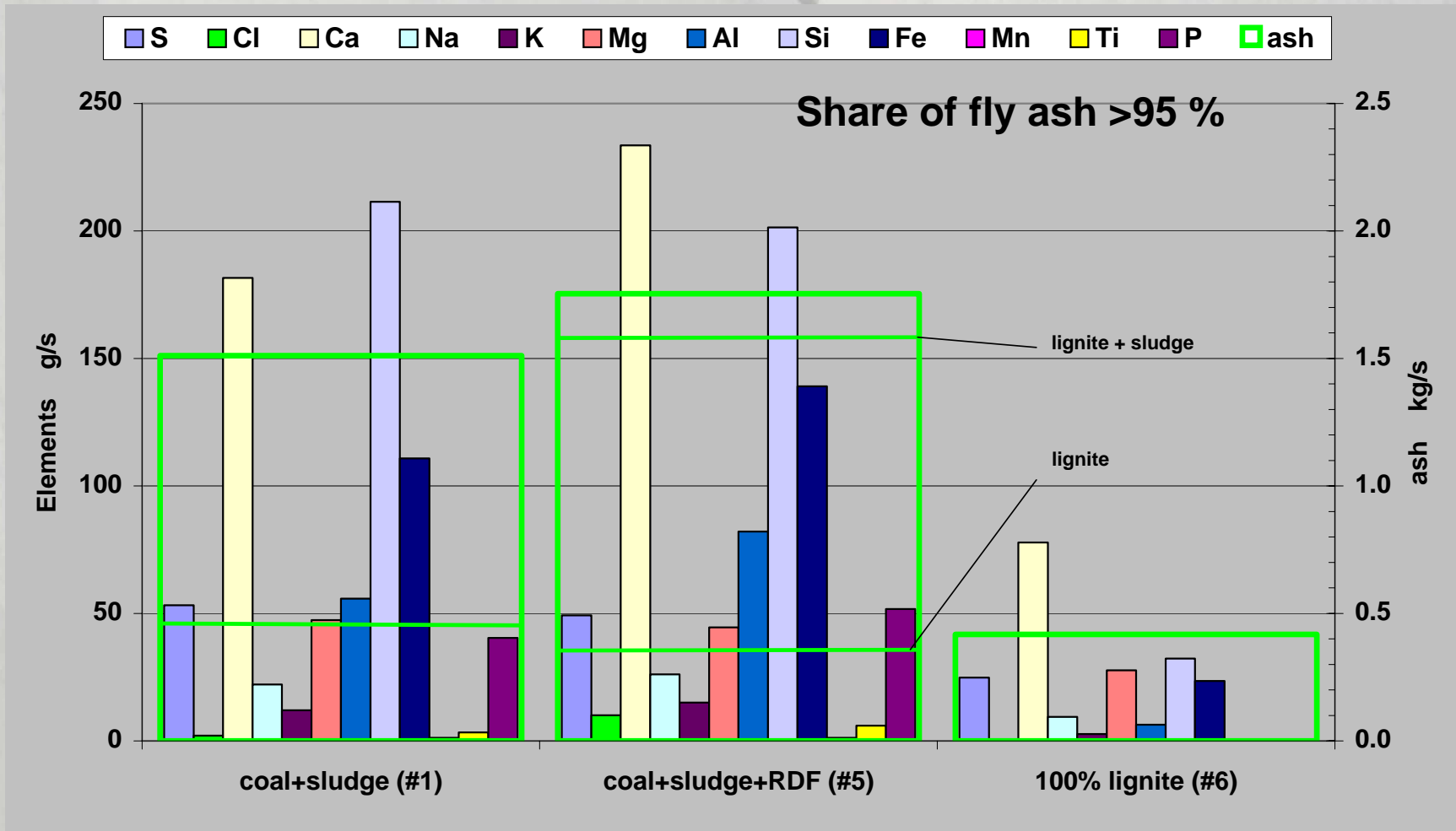
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Test run		#1	#5	#6
Additional fuels		Sludge	Sludge RDF	-
Load	%	86	77	62
T bed	°C	811	789	807
T cyclone	°C	831	810	813
O ₂	%, dry	4.0	3.7	4.1
SO ₂	mg/Nm ³ ⁽¹⁾	115	60	68
SO ₂ retention	%	91	96	92
Ca/S tot	mol/mol	3.0	3.4	2.7
CO	mg/Nm ³ ⁽¹⁾	21	32	0
NO _x	mg/Nm ³ ⁽¹⁾	154	104	124
Hg	µg/Nm ³ ⁽¹⁾	4	6	0
HCl	mg/Nm ³ ⁽¹⁾	15	49	14
RDF share ⁽²⁾	%	-	13	-

(1 Emissions expressed in 7% O₂ ; (2 Based on heat input

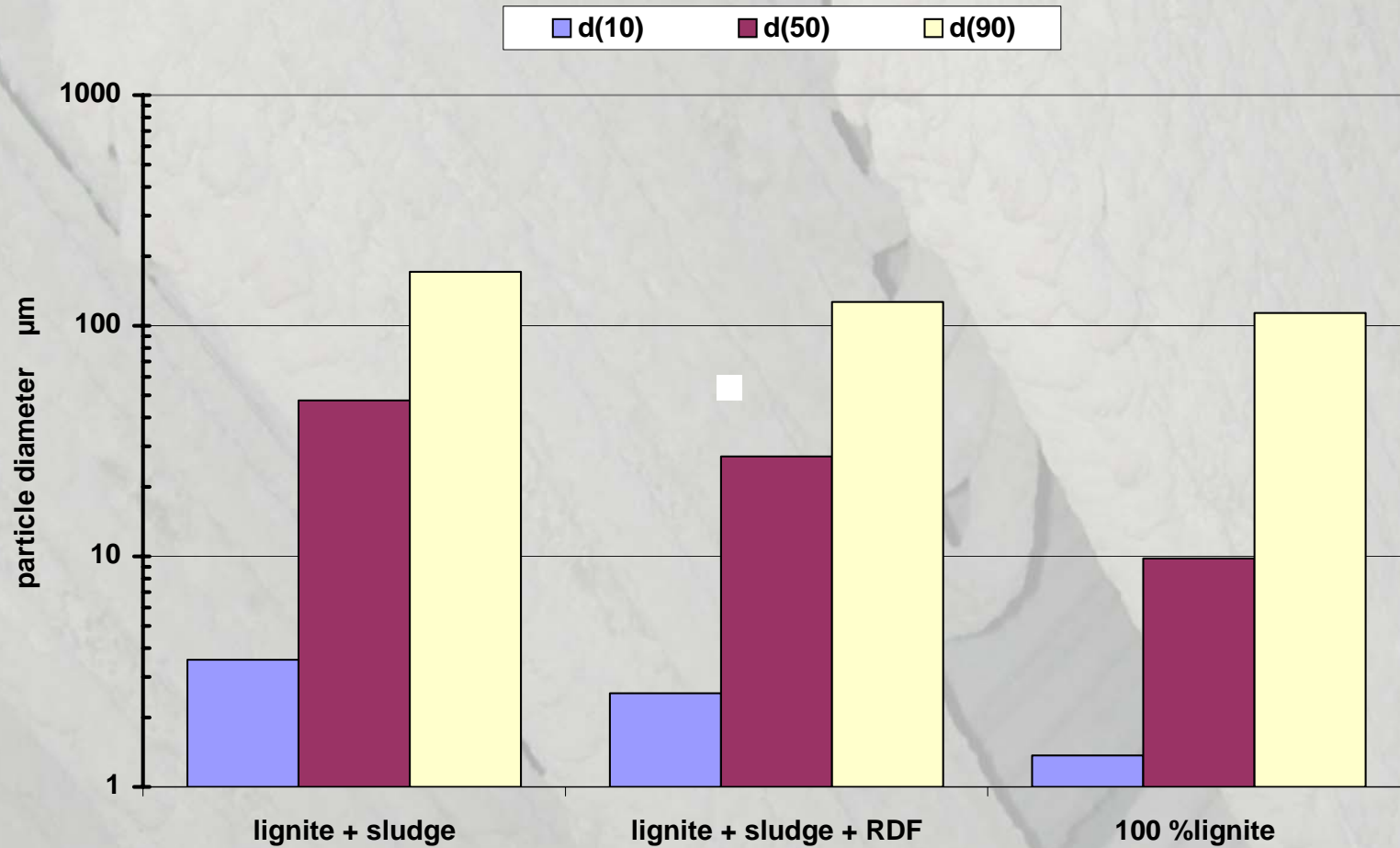
SOLIDS BALANCE OF FUELS

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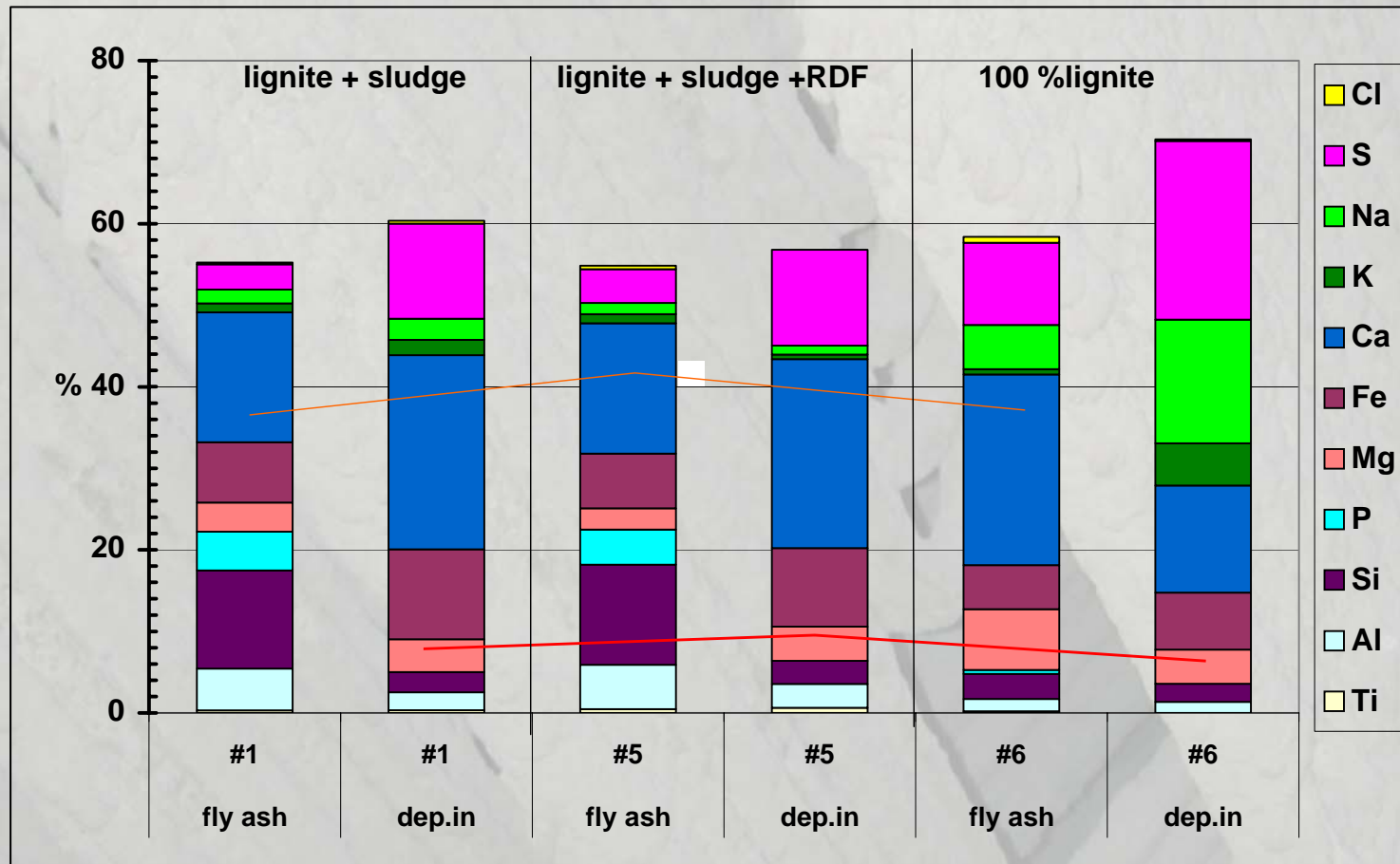
Particle size of fly ash

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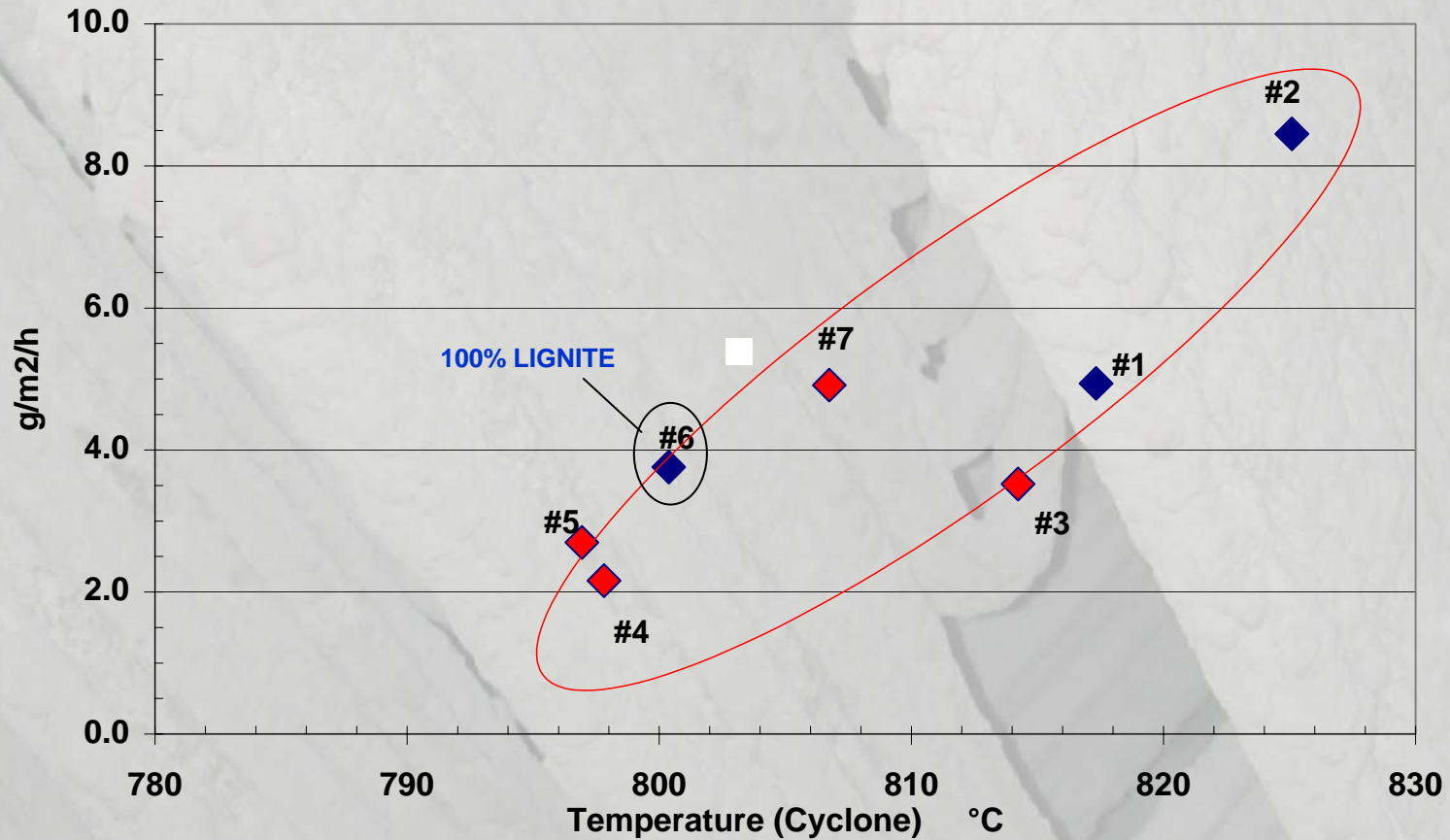
Composition of fly ash and deposit

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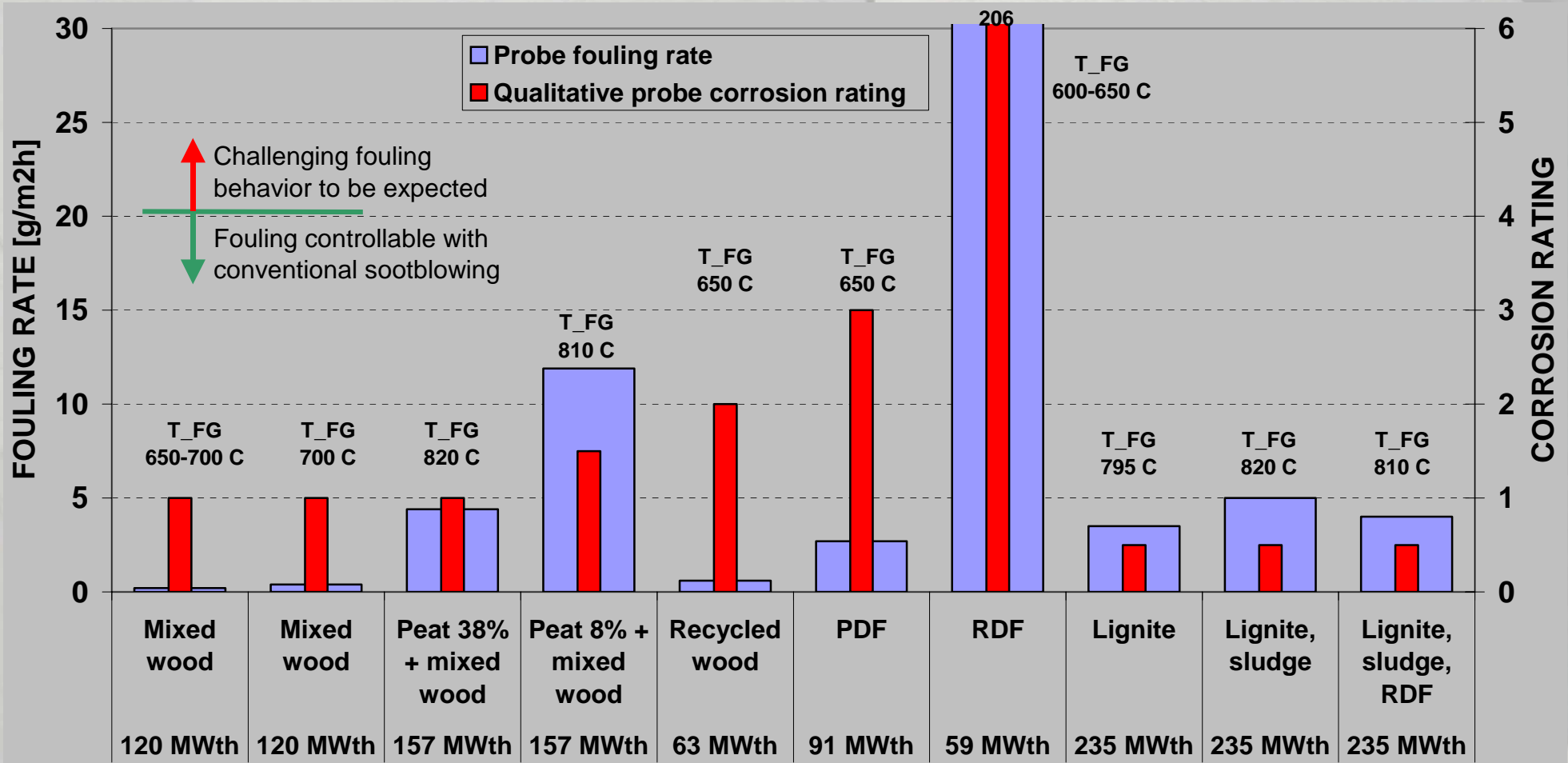
FOULING RATES MEASURED BY DEPOSIT PROBES

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COMPARISON OF PROBE TEST RESULTS FROM BOILERS WITH DIFFERENT FUEL COMBINATIONS

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CO-COMBUSTION OF LIGNITE AND RDF IN A CFB BOILER

SUMMARY

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MAIN CONTRIBUTING FACTORS TO SUCCESSFUL TEST RESULTS

- the proportion of RDF was low
- tolerable content of Cl, Zn, Pb in RDF
- ash originating from wastewater sludge dominated the solids characteristics
 - absorption or dilution of the fouling elements
 - particle size of fly ash with sludge was coarser than ash from lignite alone
- chlorine corrosion was not detected

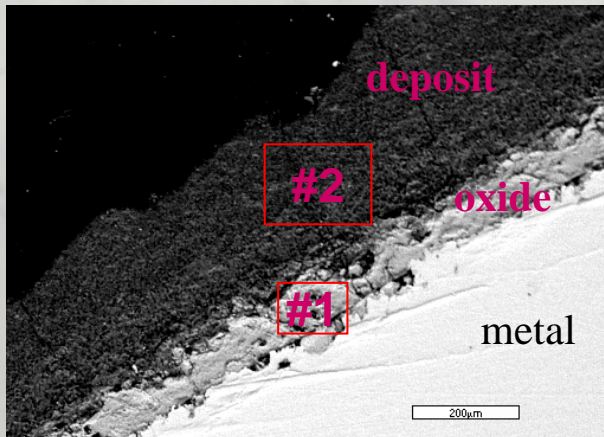
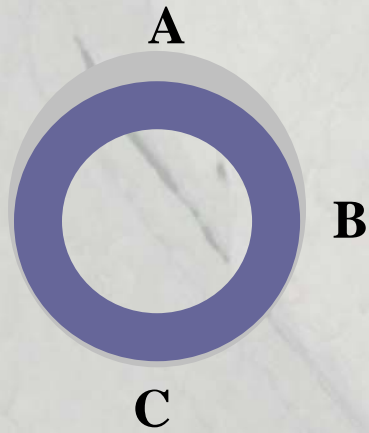
CO-COMBUSTION OF LIGNITE AND RDF IN A CFB BOILER SUMMARY

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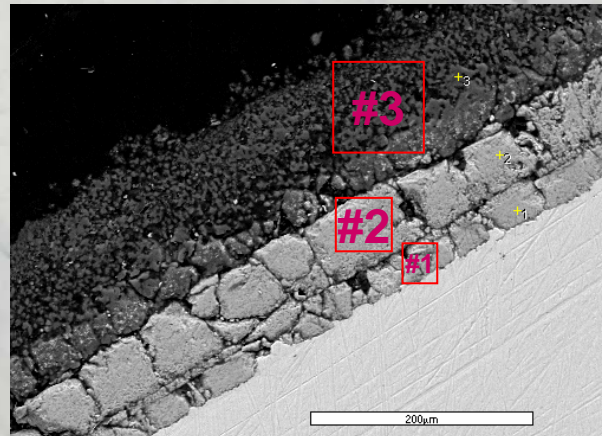
**CO-COMBUSTION OFFERS AN ENERGY EFFICIENT WAY OF
THERMAL RECYCLING. HOWEVER, PROCESS CONDITIONS AND
BOILER CONSTRUCTION NEED TO BE EVALUATED INDIVIDUALLY
AND FOLLOWED UP DURING OPERATION**

DEPOSIT PROBE AFTER 100% LIGNITE COMBUSTION

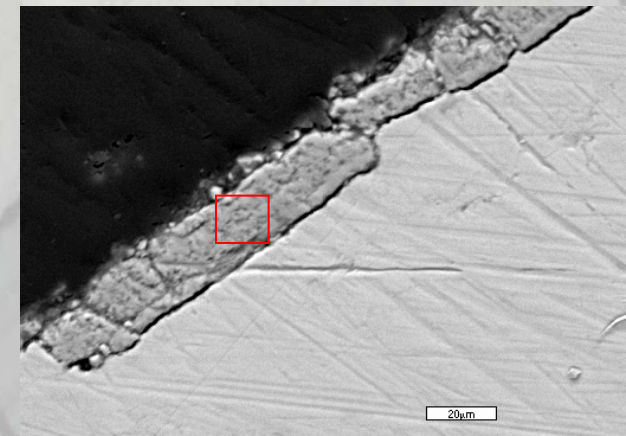
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A) windward ($d_{ox.}$ 105µm)



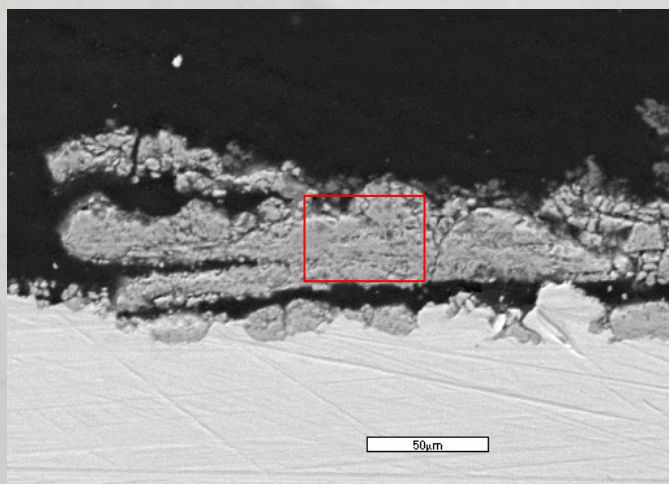
B) side wall ($d_{ox.}$ 90µm)



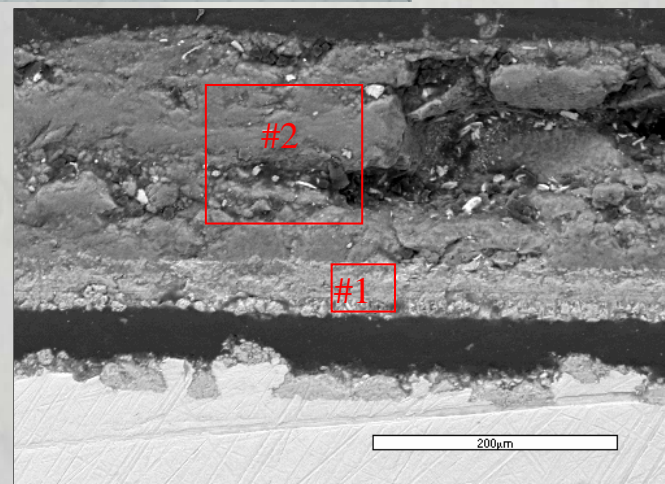
C) leeward ($d_{ox.}$ 30µm)

DEPOSIT PROBE AFTER LIGNITE AND SLUDGE CO-COMBUSTION

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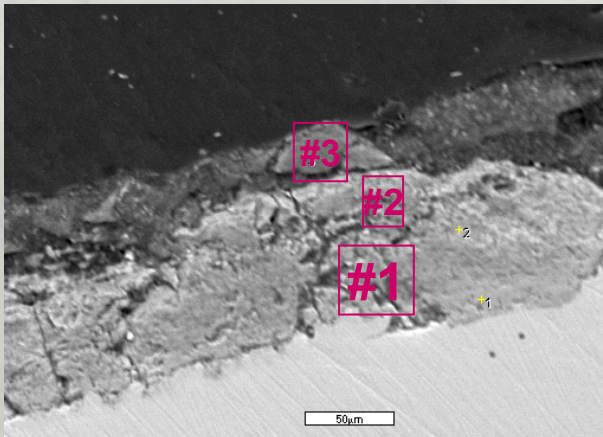
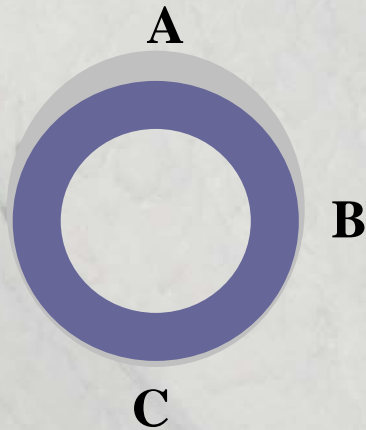
A) Windward (d_{ox} . 50µm)



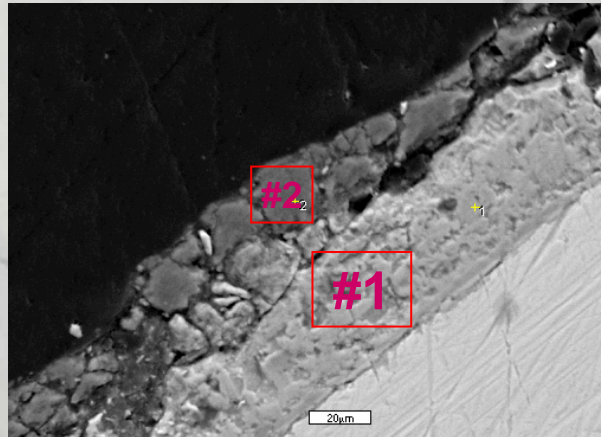
B) Leeward (d_{ox} . 50µm)

DEPOSIT PROBE AFTER LIGNITE, SLUDGE AND RDF CO-COMBUSTION

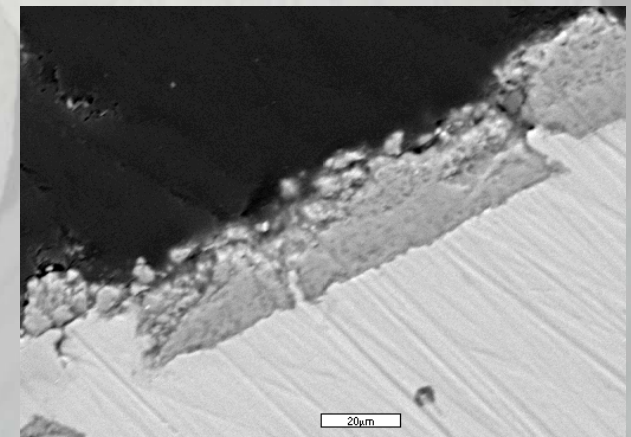
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A) windward (d_{ox} . 135µm)



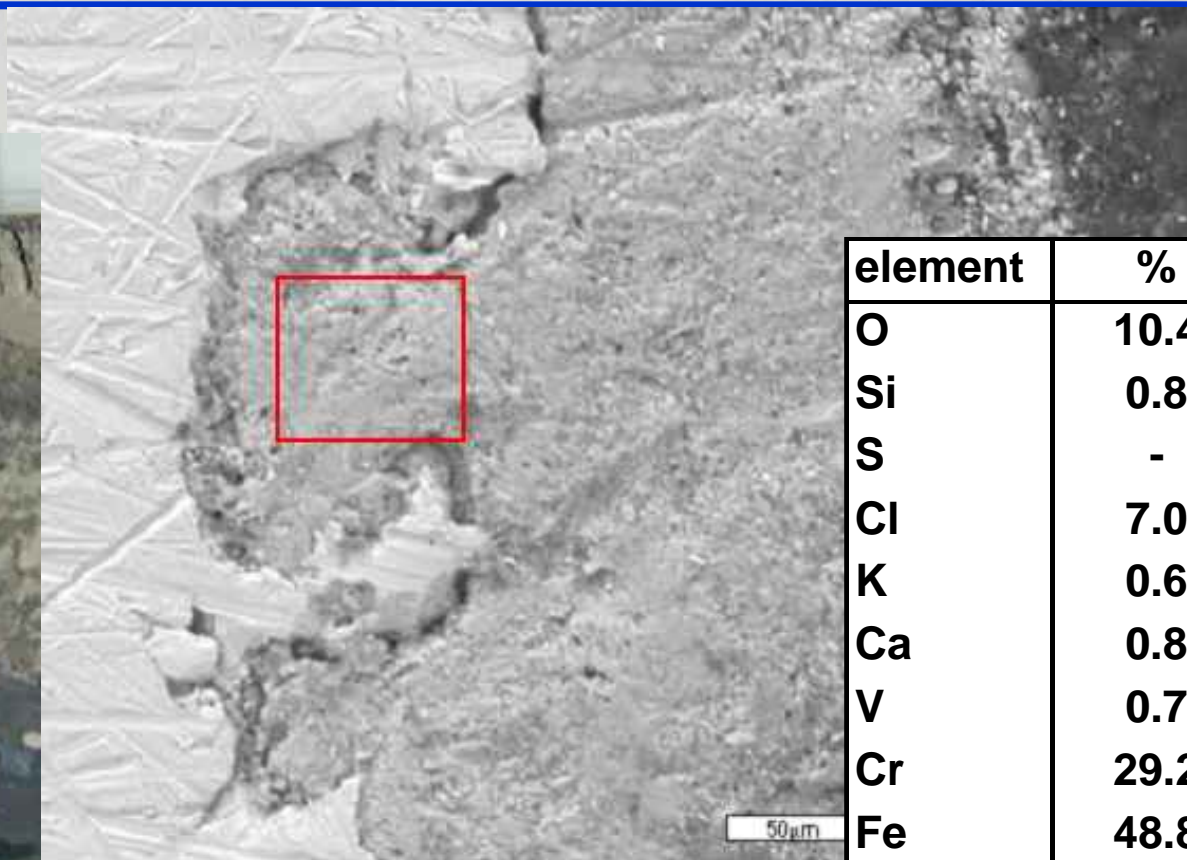
B) side wall (d_{ox} . 40µm)



C) leeward (d_{ox} . 30µm)

FOR COMPARISON : PROBE IN 100% RDF FIRED BOILER

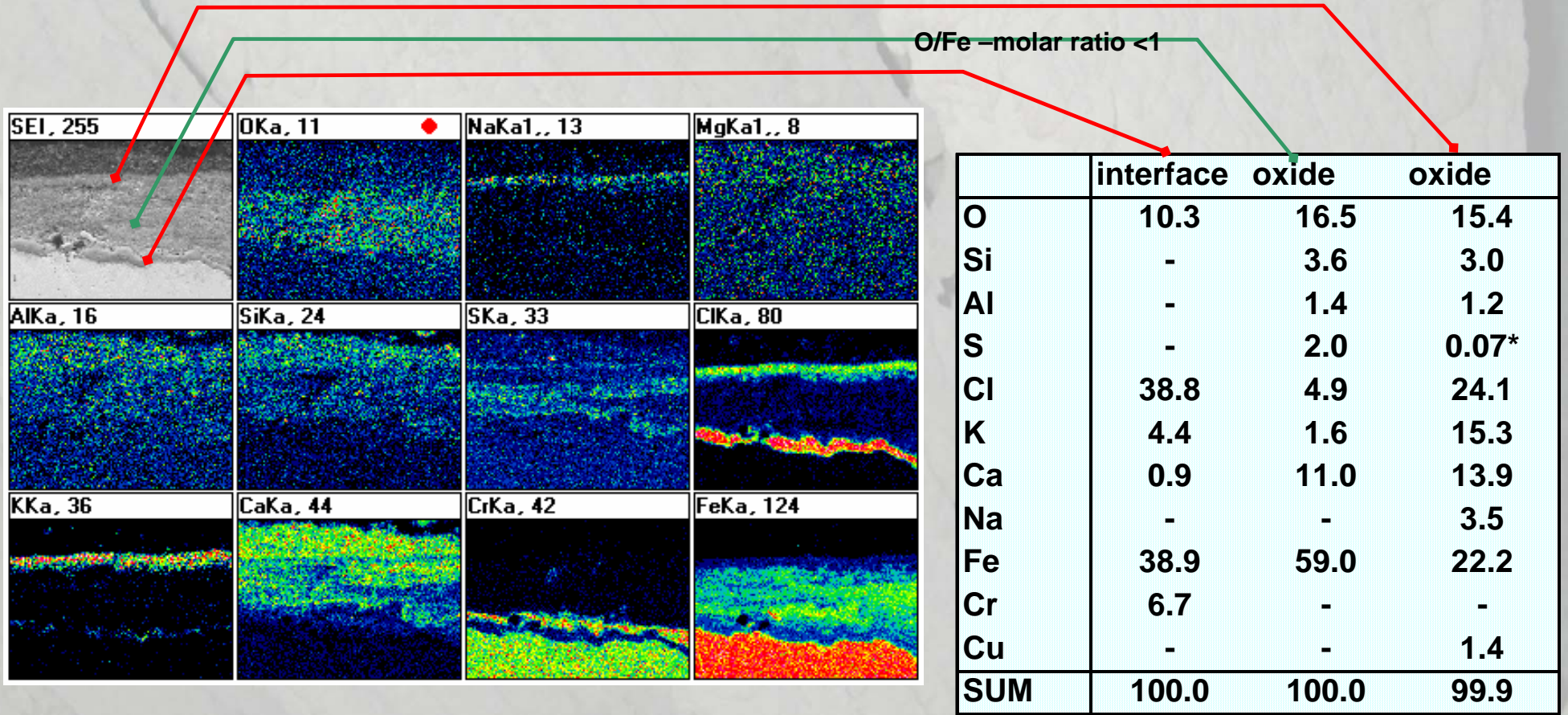
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element	%
O	10.4
Si	0.8
S	-
Cl	7.0
K	0.6
Ca	0.8
V	0.7
Cr	29.2
Fe	48.8
Ni	2.1
Sum	100.4

FOR COMPARISON : PROBE IN RDF /SLUDGE PILOT TEST

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INSTALLATION OF PROBES

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