ASH PROPERTIES, DEPOSIT FORMATION AND CORROSION OF SUPERHEATER TUBES OF MUNICIPAL SOLID WASTE FIRING IN SWIRL FLUIDIZED BED FURNACES

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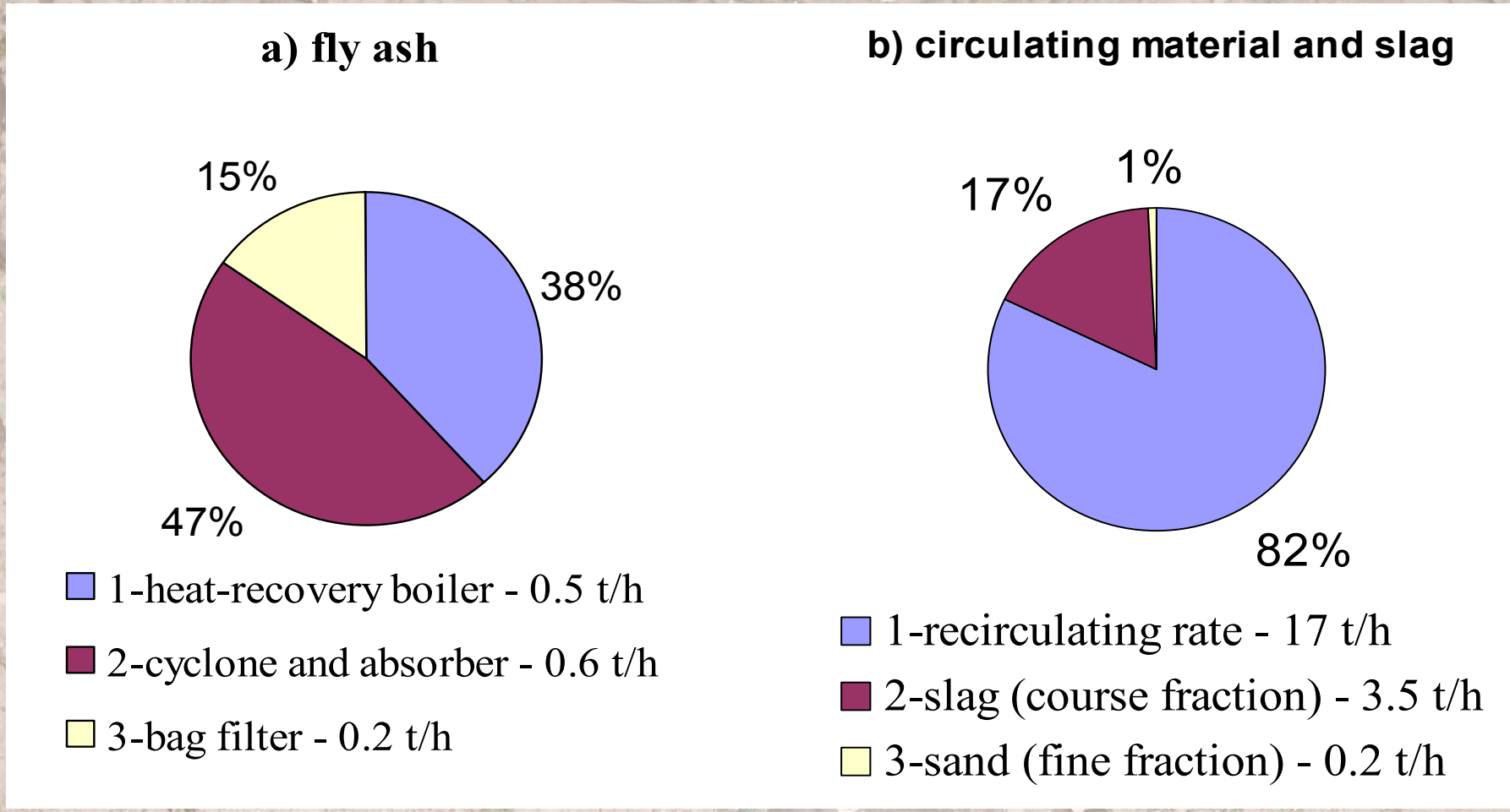
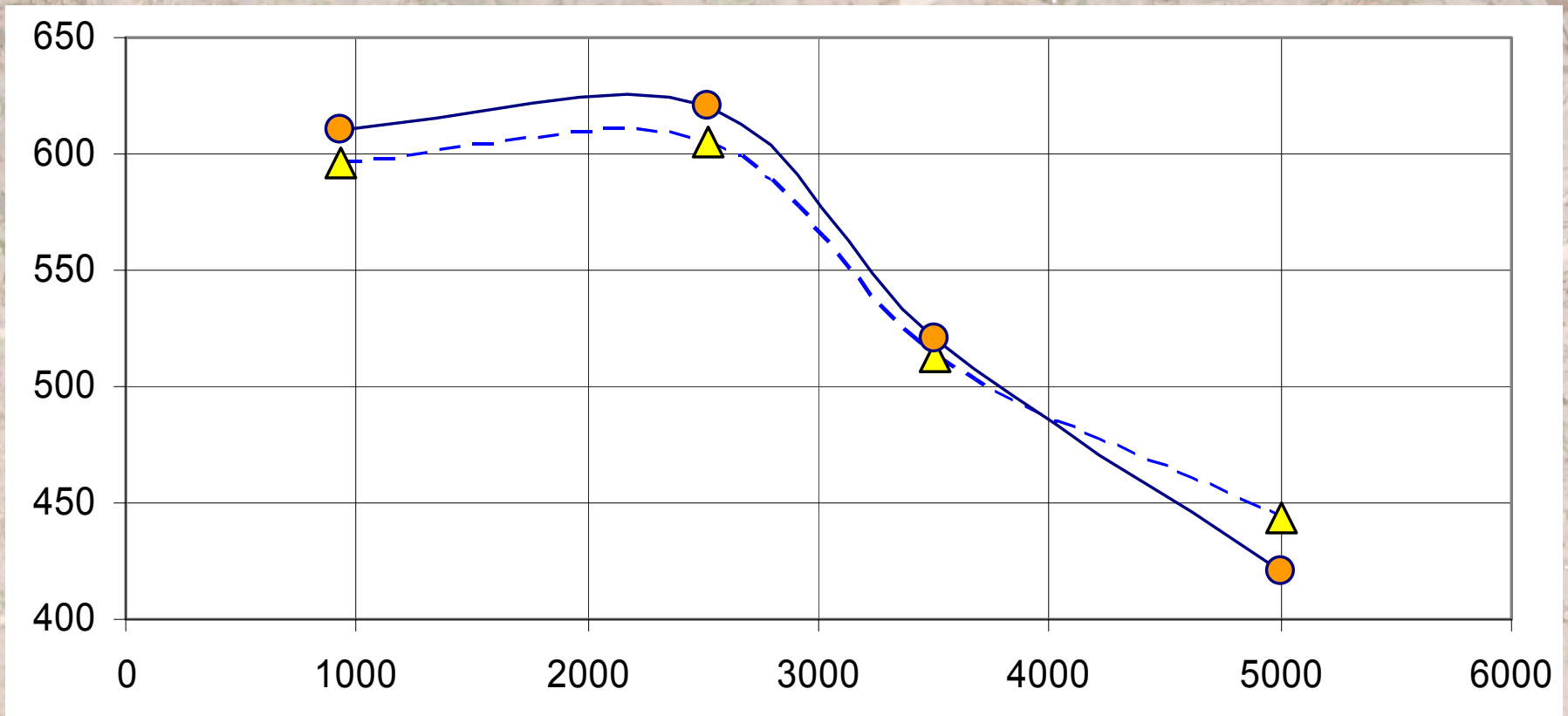
- *The results of corrosion tests*
- *Conclusions*

Flow rates and fractions of fly ash (a) and recirculating material (b)



View on the superheater tubes (upper portion – left-side, bottom portion – right-side)

Gas temperature variation over the channel height at the superheater inlet



The deposit composition

	Front	Rear	Wall	Average
SiO_2	9.3	14.3	6.5	10.63
TiO_2	1	1.0	0.4	0.83
Al_2O_3	17.1	10.6	5.3	12.10
Fe_2O_3	2.0	2.0	0.7	1.72
CaO	17.5	25.7	11.0	19.24
MgO	1.0	2.3	1.0	1.50
K_2O	10.7	6.3	10.2	8.91
Na_2O	3.7	6.7	5.2	5.13
SO_3	12.8	13.9	29.2	16.76
P_2O_5	1.4	2.9	1.5	2.02
MnO	0.4	0.1	0.5	0.31
Cl	18.2	10.5	23.5	16.39
Cu	1.8	1.0	1.9	1.50
Pb	1.8	1.4	2.3	1.77
Zn	1.1	1.0	0.8	1.01
Ni	0.008	0.0080	0.0	0.01
Cr	0.06	0.06	0.0	0.05
Ba	0.1	0.1	0.1	0.09
Weight, g	3.869	2.857	2.358	9.084
%	40.3	38.2	21.5	100.0

Corrosion damage of the superheater drainage tube

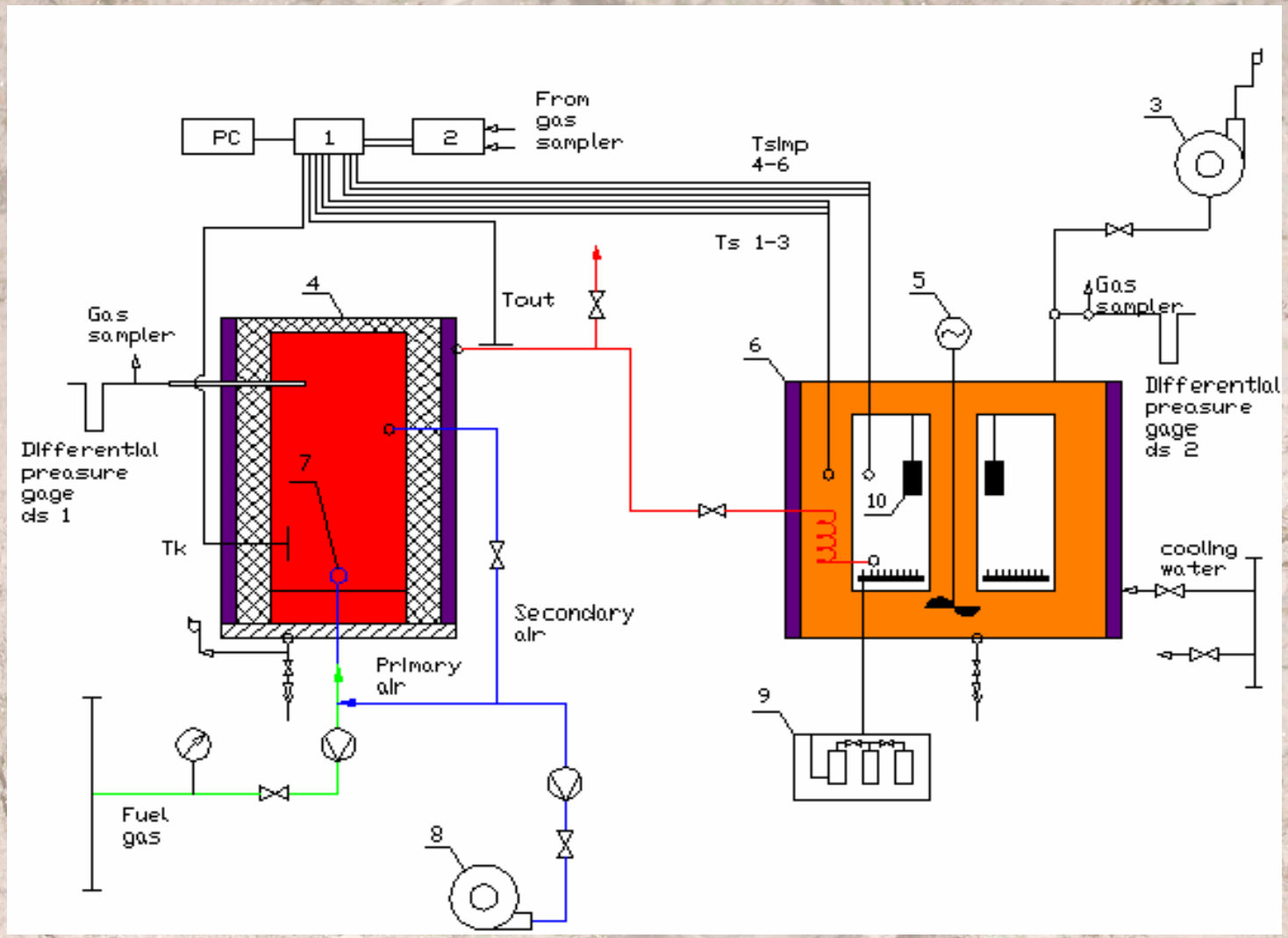
(steam boiler in MSWIP "Rudnevo", Moscow)

The test rig simulates the corrosion process typical for MSW and biomass incineration plants.

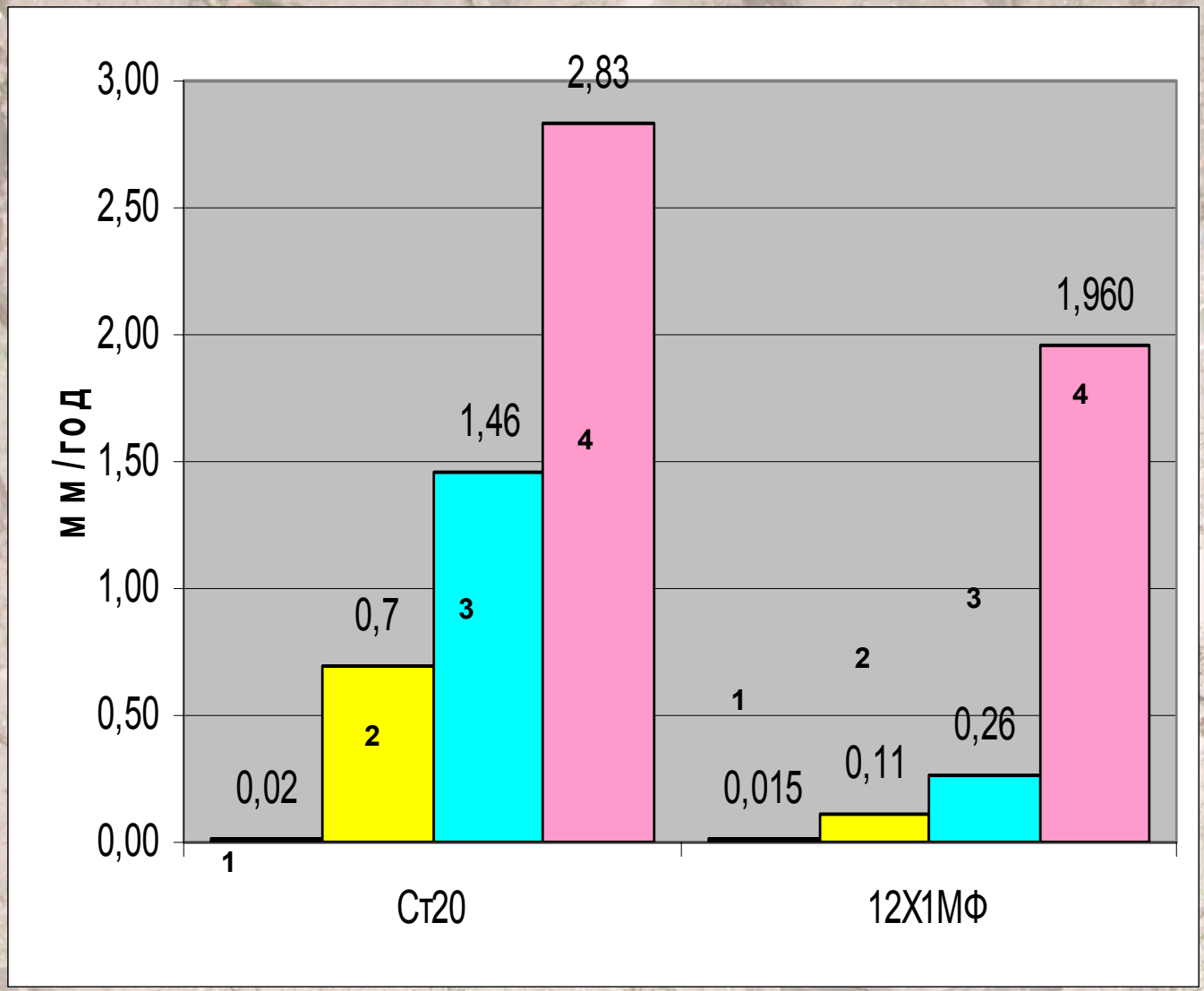
The design of the test rig allows to carry out the corrosion investigations varying the following characteristics:

- *partial pressure (concentration) of HCl, SO_2, H_2O, O_2;*
- *flue gas temperature to 600 ºC;*
- *composition of deposits (content of alkali chlorides CClm, calcium components $C_{CaO}{}^m$ and sulphates $C_{SO3}{}^m$);*
- *exposure to 1500 hrs.*

The experimental rig of VTI for investigation of corrosion processes



The influence of various factors on the corrosion rate



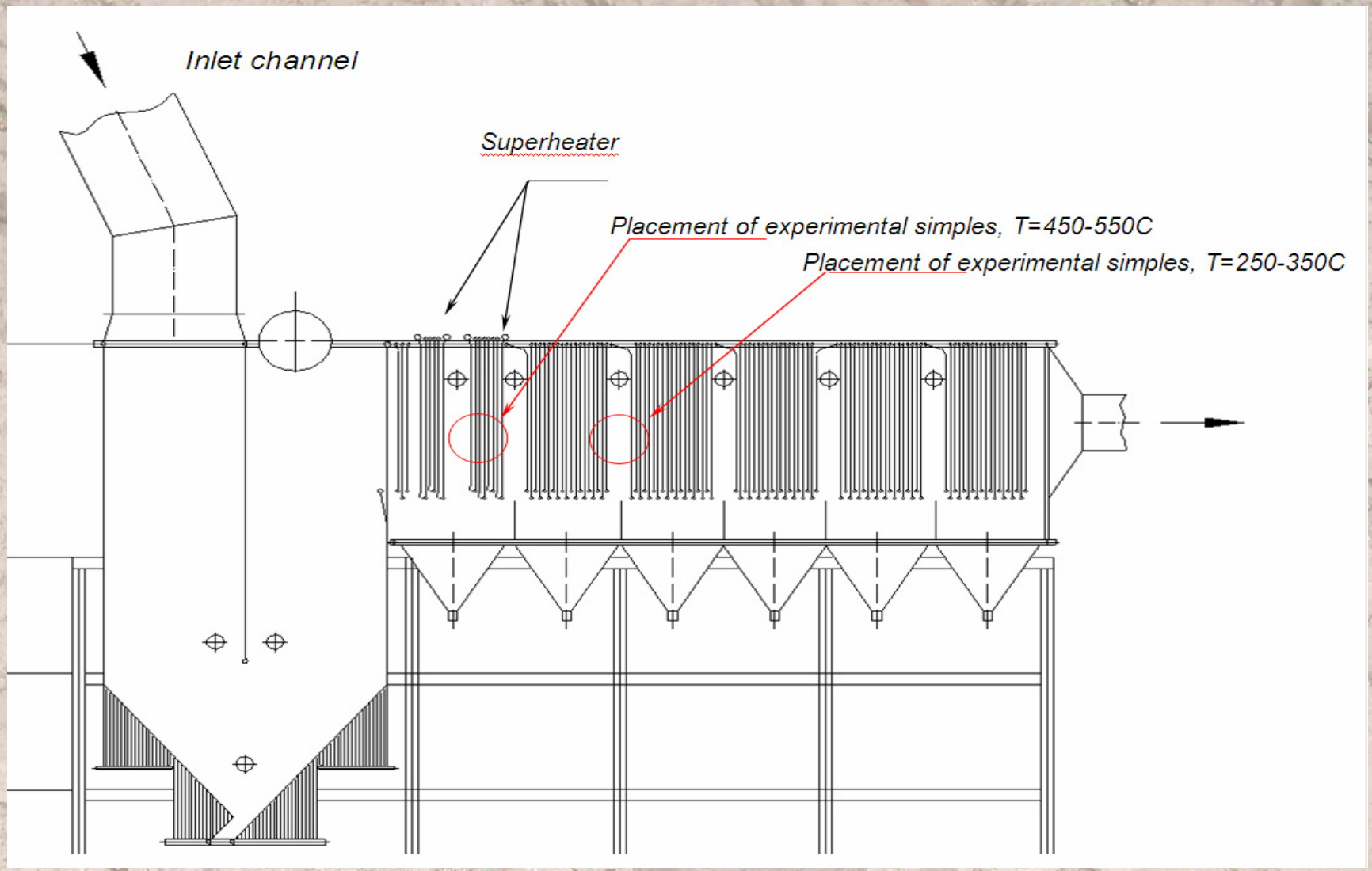
1 – air medium

2 – w/o deposits, gaseous medium HCl=250 mg/m³

3 – in deposits Cl=2.5 % (mass), gaseous medium HCl=250 mg/m³

4 – in deposits Clm=30 % (mass), gaseous medium HCl=250 mg/m³

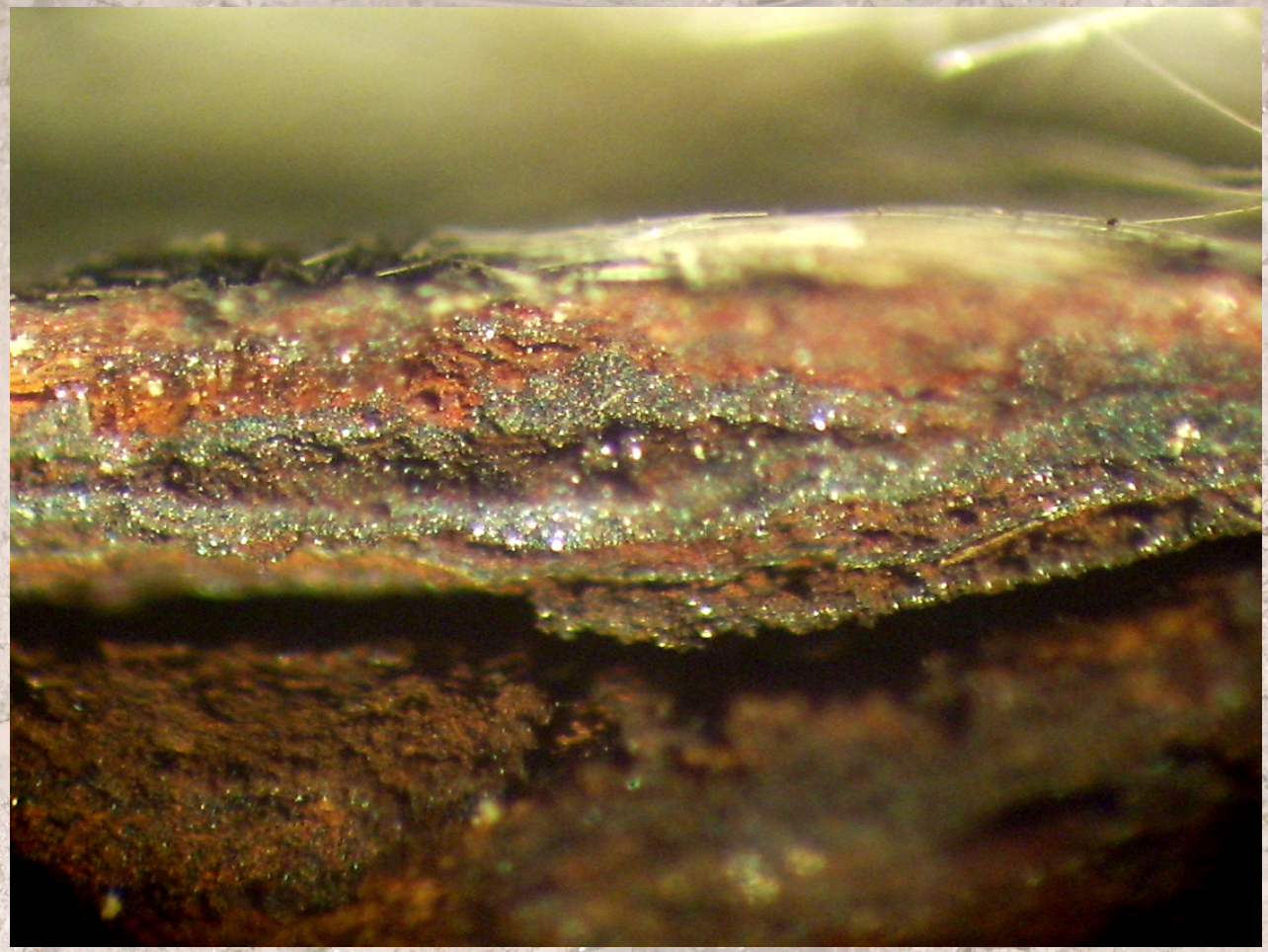
Placement of experimental simples in exhaust-heat boiler during of industrial corrosion tests



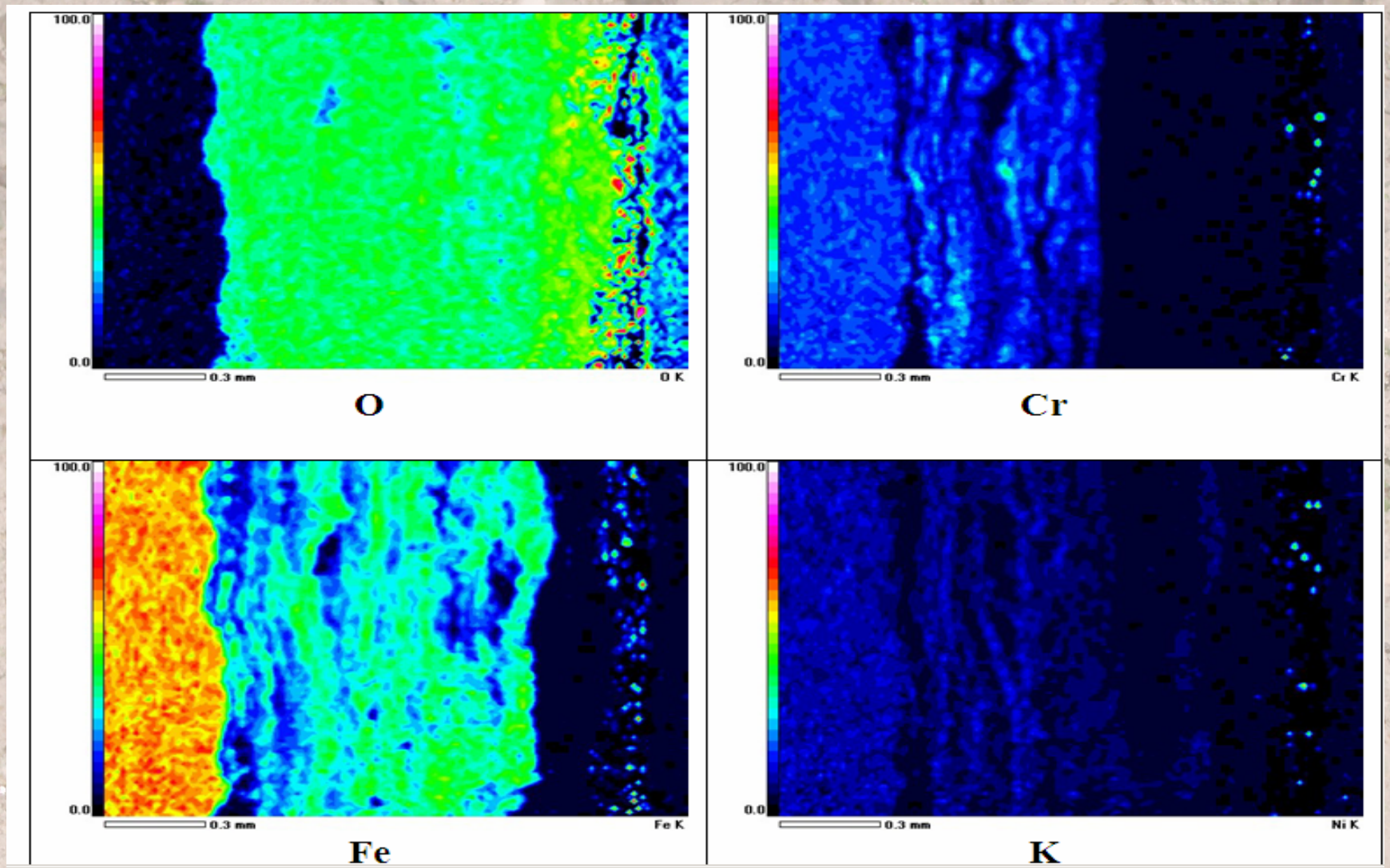
The microsection of 12Cr18Ni10T austenite steel specimen

After 1700-hours tests, t=450 ºC, in the MSW combustion product medium HCl=150÷250 mg/m^3

The porous layer of the corrosion products (thickness more 1.5 mm)



The results of micro X-ray spectral analysis the composition of the corrosion products



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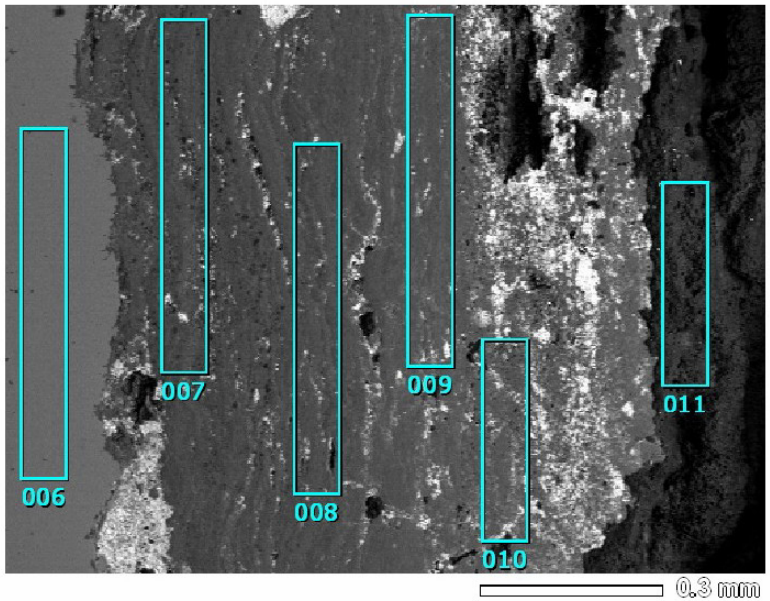

Memo	O	Na	Mg	Al	Si	S	Cl	K	Ca	Ti	Cr	Fe	Ni	Cd	Pb	Total(n
006					0.72					0.50	18.80	69.69	10.29			100.00
007	38.00	4.88		0.23	0.83			0.39	0.42	0.49	16.22	27.78	7.71	0.62	2.43	100.00
008	38.41	1.70		0.23	0.69			0.39	0.56	0.41	15.20	31.83	7.69	0.60	2.30	100.00
009	39.69	0.90	0.29	0.14	0.51			0.35	0.21	0.37	12.71	33.28	4.69	2.11	4.75	100.00
010	38.50	3.08	0.26	0.71	0.85	1.27		0.76	0.53	0.18	0.39	41.55	4.47	2.40	5.04	100.00
011	48.55	25.22	0.92			15.84	0.51	3.00				0.31		3.94	1.72	100.00

Conclusions

The investigations were carried out to get enough information about the following questions:

- *conditions of formation, transformation and transport of slag and corrosion elements during incineration and heat utilization.*
- *main factors of deposits formation and high-temperature corrosion.*
- *kinetics of deposits formation and high-temperature corrosion process.*
- *corrosion stability of Russian boiler steels in condition of flue gas of MSWI P.*

The data obtained can be used for recommendations on optimization of the design of the heat-recovery boilers of MSWIP.


Thank you for attention!