



11th INTERNATIONAL SCIENTIFIC CONFERENCE  
ACHIEVEMENTS IN MECHANICAL & MATERIALS ENGINEERING

## Erosion damage and protective coating for water walls of CFB boilers

B. Formanek<sup>a</sup>, K. Szymański<sup>a</sup>, A. Hernas<sup>a</sup>, B. Kowalski<sup>a</sup>, L. Mirecki, A. Włodarczyk<sup>b</sup>

<sup>a</sup>Silesian University of Technology, ul. Krasińskiego 8, 40-019 Katowice, Poland

<sup>b</sup>Boiler Engineering Factory "RAFAKO" S.A., ul. Łąkowa, 3347-400 Racibórz, Poland

The paper presents the problem of erosion-corrosive wear of the water walls of circulating fluidized bed boilers heated with hard coal. Extension of service durability of the boilers' walls required a development of an effective technology of thermal spraying of coatings made of powder materials containing modified carbide phases or intermetallic phases. Examples of erosion damage and of erosion-corrosive wear after service are presented in the paper. The HVOF, a technology of supersonic spraying of coatings, has been identified as the proper one to produce coatings of high resistance in complex wear conditions.

### 1. INTRODUCTION

Problem of erosion wear of the CFB boiler water walls has been solved by changes in construction and technology connected with correction boiler operating parameters and with use of thermally sprayed coatings in the lower part of the walls [1-5].

Rafako S.A. and Alstom Power reference list circulating fluidized bed boilers are in table 1 presented.

Table 1  
Rafako S.A. and Alstom Power reference list circulating fluidized bed boilers

Order in	Plant name	Country	Number of boilers	Boiler capacity t/h	Live/reheated steam		Fuel
					pressure [MPa]	Temperature [°C]	
1992	Bielsko II CHP Plant	Poland	1	230	13,8	540	Hard coal
1993/98	Żerań II CHP Plant	Poland	2	450	10,0	510	Hard coal
1992	Bielsko II CHP Plant	Poland	2	230	13,8	540	Hard coal
1994	Mironowska Power Plant	Ukraine	1	260	13,8	540	Anthracite
1998	Siersza Power Plant	Poland	2	425	16,1/4,0	560/560	Hard coal

## 2. THE PURPOSE AND SCOPE OF RESEARCH

The main purpose of a wide range of research was to develop and implement a technology of producing coatings characterized by high resistance to erosion and corrosive wear at elevated temperatures. In the material and technological conception of the coatings production, it has been assumed that they would be used for the protection of water walls in CFB boilers. The scope of the research covered:

- development of assumptions as well as the material and technological conception of coatings production,
- choice of the coatings production technology directly in the power generating facility,
- development of a supersonic technology of HVOF spraying of coatings from selected materials,
- production of coatings on the CFB boilers' water walls
- evaluation of wear and durability of protected parts of water walls.

## 3. RESULTS

The water walls after one year exploitation in OFz-450B Żerań (Figure 1-2) and OFz-425 I - Siersza Power Plant (Figure 4) are presented. The coatings were sprayed by Metal Spray (M-S).

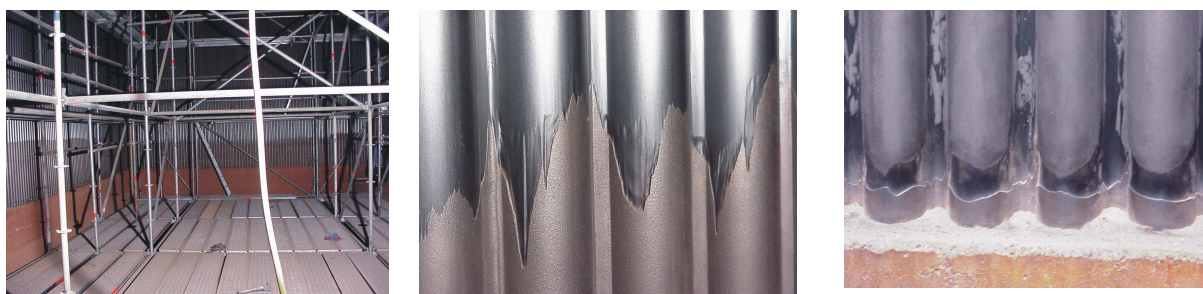


Figure 1. Water walls after one year exploitation, OFz-450A Żerań. Coatings sprayed by M-S



Figure 2. Water walls after one year exploitation, OFz-450B Żerań. Coatings sprayed by M-S

Characteristic examples of coating wear damage in the work lower part have been elevated to determine mechanism of erosion (figure 3).

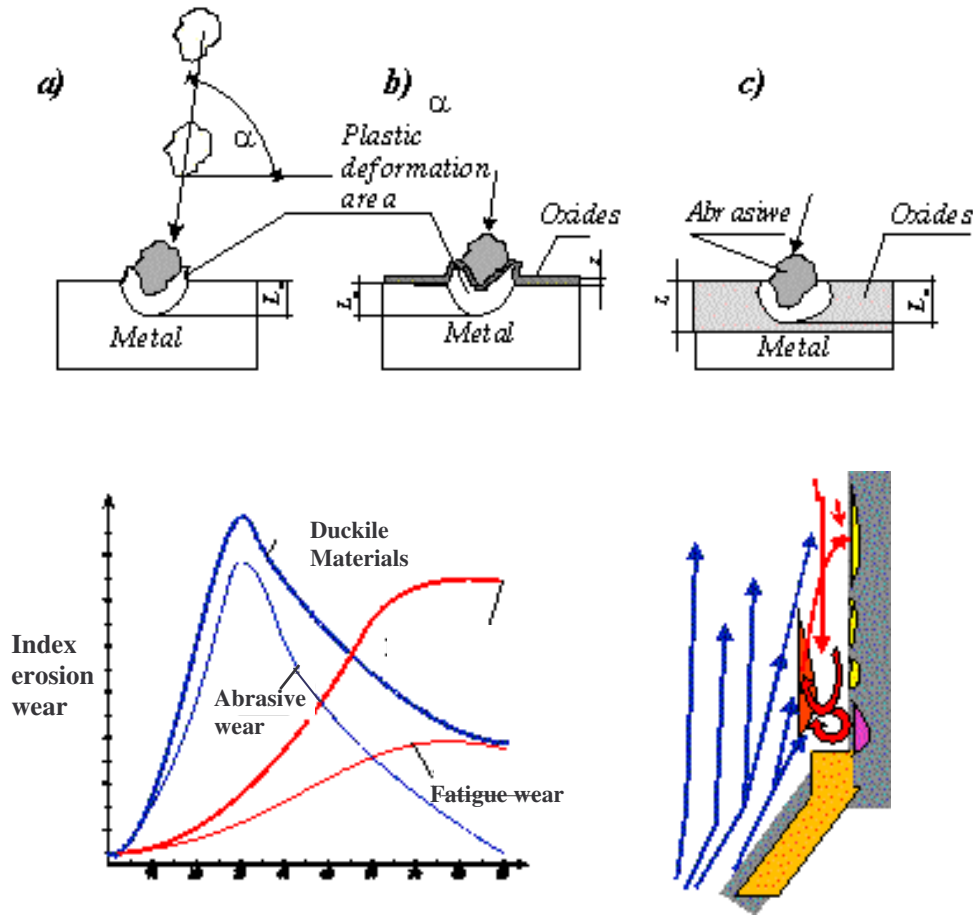


Figure 3. Mechanism of erosion-corrosion damage of water walls of CFB boilers

The new materials with dispersive carbide and intermetallics phases for the applications at elevated temperature were sprayed at the water walls in Power Plant Siersza.

The examples of the new thermally sprayed coating by ERCORTECH system are presented in Figure 5-6 too.

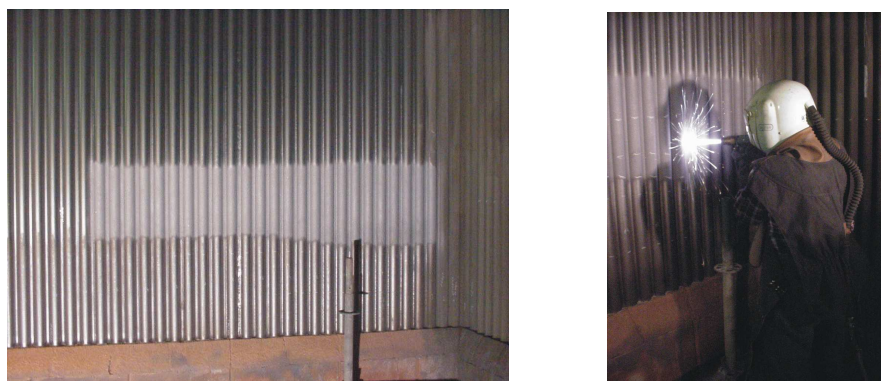


Figure 4. Example of coating sprayed by ERCORTECH



Figure. 5. Water walls after one year exploitation, OFz-425 I - Siersza Power Plant

#### 4. CONCLUSION

The problem of erosion wear of the fluid boilers being in service in Poland has been solved by:

- application of thermal spraying process of hard and erosion resistant coatings with dispersion intermetallic phases at elevated temperature;
- protection of upper and lower edges of the bulkheads by means of metallic shields or coatings;
- change of brickwork profile over the combustion chamber funnel;
- making the flat walls of bulkhead super heaters from double super-omega pipes or welded pipes of pipe-flat iron-pipe type;
- making combustion corners which eliminate the need of filling them with brickwork.

Regardless of the above the requirements for charge materials and their chemical composition, graining and operating of FB boilers should be met.

The paper presents a selected part of the spraying technology of coatings of very good utilitarian properties, intended for the power industry and produced by the service of ERCORTECH RAFAKO S.A. and the Silesian University of Technology.

#### REFERENCES

1. B. Formanek: „Development of new materials with high dispersion intermetallic phases and HVOF -high velocity oxy-fuel thermal spraying technology for composite coatings with high corrosion and erosion resistance at elevated temperature”; COST- 522 „Ultra Efficient Low Emission Power Plants”.
2. A. Hernas, B. Formanek: „Corrosion –erosion damage of power plant boiler components, developing materials and technologies increasing operating durability”; COST- 522,
3. B. Formanek, K. Szymański: Research works conducted by the Silesian Technical University and the „Rafako” Boilers Factory.
4. B. Formanek: „Aluminocarbothermal synthesis of composite powders with intermetallic phases and dispersion oxides”; „Achievements in Mechanical and Materials Engineering”, 9th International Scientific Conference, October 2000, ed L. Dobrzański.
5. B. Formanek, K. Szymański, M. Hetmańczyk: „SHS synthesis of composite powders with FeAl, TiAl intermetallic phases and dispersion oxides”, AMME, 9th International Scientific Conference, October 2000, ed L. Dobrzański.