Development of Coating Technology for Preventing Sulfide Corrosion on Boiler Tubes in Coal Fired Power Plants − Development of a Practical Compound Film of Low-cost and High Corrosion Resistance −

Background

In coal fired power plants, the concentration of H_2S becomes higher in the burner area where there is a strong reducing atmosphere. Therefore, the boiler tubes are damaged due to sulfide corrosion. The damaged tubes should be repaired by buildup welding or thermal spraying. If the damage by sulfide corrosion is large, the boiler tubes need to be replaced. Thus, these repairs become costly. To deal with this problem, we have embarked on development of an economical and straightforward technique of coating for preventing sulfide corrosion in 2004. We designed the compound film of TiO_2 and the carbon film in 2006. The sulfide corrosion could be reduced by 50%. However, the corrosion resistance of the film did not achieve the required value (10%).

Objectives

This study aims to develop film structure which has high corrosion resistance on the basis of current coating technology. Moreover, the coating process is simplified.

Principal Results

1. Success in development of compound film that has superior corrosion resistant to 10% or less

In order to improve the corrosion resistance, the coating film has to improve the gas-tightness. SiO_2 is selected as a prime film material, and $SiO_2/TiO_2/C/TiO_2$ compound film is developed. As a result of the sulfide corrosion test performed, the developed film demonstrated corrosion of 10% or less compared to that in the uncoated sample (Fig.1, Fig.2). In addition, this coating didn't affect the structure of base metal such as carburization.

2. Simplification of coating process for low cost

In previous coating processes, the oxidation or degreasing were performed during each coating as shown in Fig 3(a). In the simple coating process, the oxidation and degreasing are performed after all coating as shown in Fig. 3(b). The performance of the film in simple process is confirmed to be the same as that in previous processes. It is possible to oxidize and degrease by the heat when the boiler starts. Therefore, the coating process can be simplified. Moreover, the coating material costs are also low as listed in Table 1. Decrease of major repair costs can be expected due to this technology compared with the protection film of 50Ni50Cr flame spray coating.

Coating of developed film on the inspection of boiler every two years ensures the boiler soundness. It is expected that the total cost of boiler life decreases because it doesn't need large-scale repairs such as buildup welding and panel exchange, etc.

Future Developments

In order to prove reliability and applicability of developed film, the durability evaluation will be performed in the coal fired power plant boiler. After that we will put it to practical use at an early stage.

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Reference

M. Kawase, et al, 2008, “Development of coating technology for preventing sulfide corrosion on boiler tubes in coal fired power plant II”, CRIEPI Report M07016 (in Japanese)

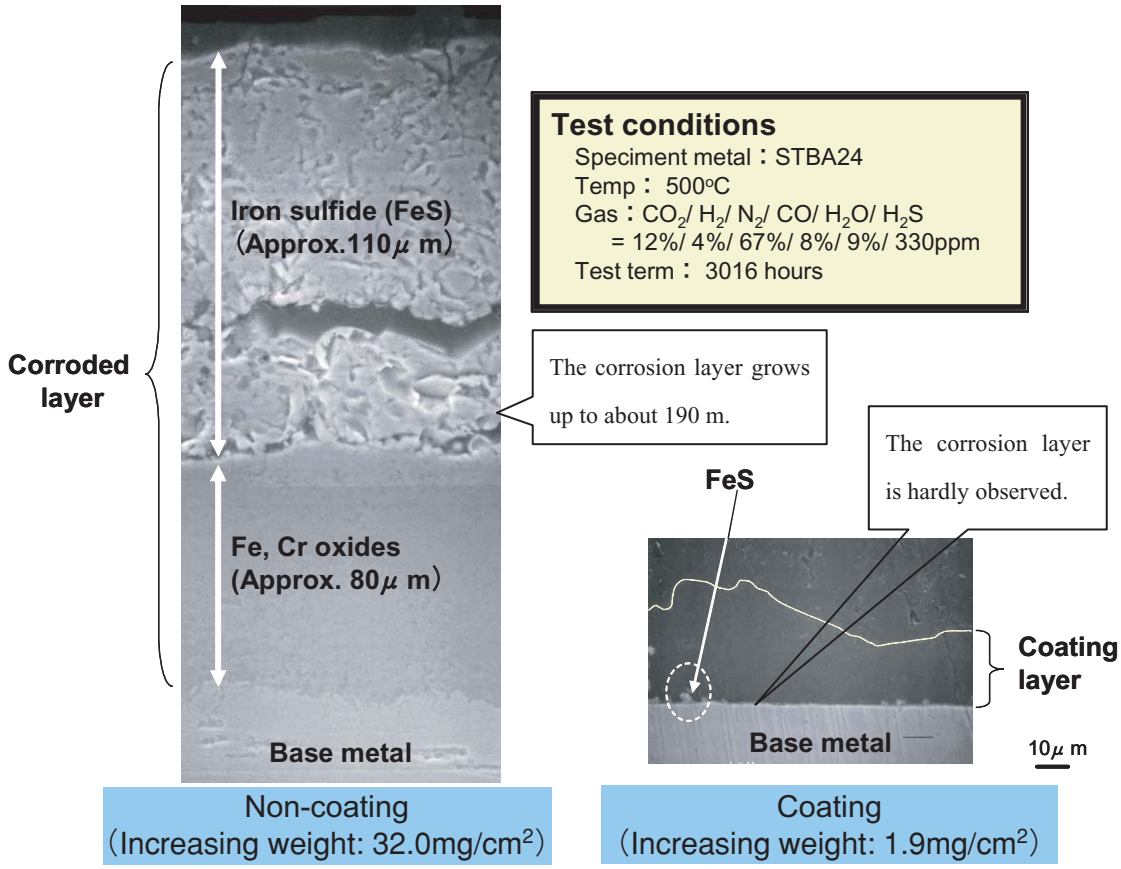

Fig.1 Comparison of sulfide corrosion between developed compound film and non-coating

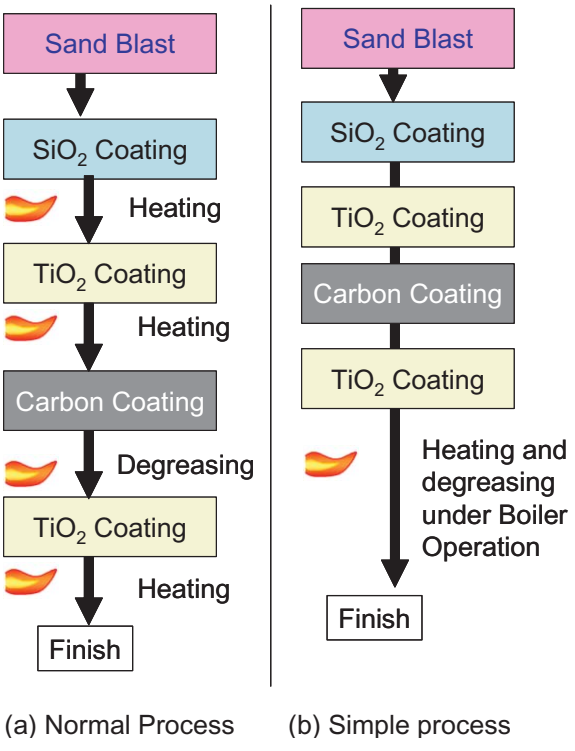

Fig.3 Coating Process

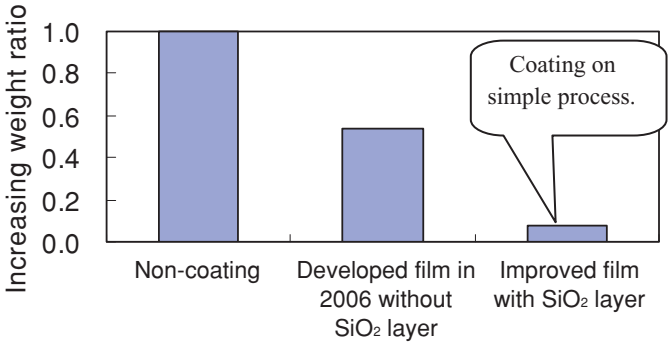

Fig.2 Performance comparisons of developed films

Table 1 Material cost for coating

Material	Thickness	Coating efficiency	Cost(yen/m^2)
SiO_2	1.0 μ m	0.6	1833
TiO_2	0.5 μ m	0.6	789
C	40 μ m	0.75	1272
TiO_2	0.5 μ m	0.6	789
		Total	4683yen/m^2