Development of Fe-Cr-Al Sputter Coatings to Resist High Temperature Chloride Environments at 550 °C

D Orlicka, N J Simms, T Hussain and J R Nicholls
Cranfield University, Cranfield, Bedfordshire, UK, MK43 0AL

In biomass-fired power plants the superheaters and reheaters are known to be particularly susceptible to chloride induced fireside corrosion damage. One approach to giving them longer lives is to develop a new coating composition that is resistant to this type of fireside corrosion damage. This paper reports the second stage of such an approach using the combinatorial model alloy development method. Physical Vapour Deposition (PVD) using a two-target magnetron sputtering system (50 wt. % Fe - 50 wt. % Cr and 70 wt. % Fe - 30 wt. % Al) has been used to obtain a range of coating compositions. The coatings were deposited onto an array of sapphire discs (10 mm diameter, 3 mm thick) placed in front of the targets. This resulted in a group of samples with coatings with a range of different Cr/Fe to Fe/Al ratios, which have been characterised using SEM/EDX and XRD.

For screening, one group of eleven coatings, representing the range of compositions generated, has been exposed at 550 °C for up to 150 hours in an air-350 vpm HCl environment. Weight change data have been gathered from these exposures after 50 and 150 hours. After each exposure period, the surfaces of the corrosion products were characterised using SEM/EDX and XRD. These techniques have been used to identify the phases formed and the morphology of the scales generated. These data have been compared to those generated from earlier trials on a wider range of coating compositions. Future activities will investigate the chloride deposit induced fireside corrosion damage of these and similar coating systems to identify the most resistant composition for their potential use in the biomass-fired power plants.