Steam oxidation of X20CrMoV121: Comparison of laboratory exposures and in situ exposure in power plants

X20CrMoV121 is a 12% Cr martensitic steel which has been used in power plants in Europe for many decades. Specimens have been removed from superheater tubes to investigate long-term exposure with respect to steam oxidation. These tubes have been exposed for various durations up to 135 000 h in power plants in Denmark at steam temperatures varying from 450–565 °C. This paper collates the data, compares oxide morphologies and assesses to what extent parabolic kinetics can be used to describe the oxidation rate. The steam oxidation behaviour has been investigated in the laboratory in an Ar-46%H2O mixture at 500, 600 and 700 °C for 336 h. It was observed that the morphology of the oxide layers was strongly influenced by temperature, and some of the same morphologies are also observed for power plant specimens. However, the temperatures at which they occur were different for plant and laboratory specimens, e.g. the presence of Cr rich bands within the oxide occurred at a lower temperature in the plant than in the laboratory. In addition there is a greater variety of oxide morphologies for long-term plant specimens compared to laboratory specimens.

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