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Effects of water vapor on protectiveness of Cr₂O₃ scale at 1073 K (Conference Paper) [\(Open Access\)](#)

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Abstract

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Fe-Cr alloy is commonly being used as boiler tube's material. It is subjected to prolonged exposure to water vapor oxidation. The ability to withstand high temperature corrosion can normally be attributed to the formation of a dense and slow growing Cr-rich-oxide scale known as chromia, Cr₂O₃ scale. However, oxidation may limit the alloy's service lifetime due to decreasing of its protectiveness capability. This paper is to presents an experimental study of thermo gravimetric and Fourier transform infrared analysis of Cr₂O₃ at 1073 K in dry and humid environment. Samples were used from commercially available Cr₂O₃ powder. It was cold-pressed into pellet shape of 12 mm diameter and 3 mm thick with hydraulic press for 40 min at 48 MPa. It then sintered at 1173 K in inert gas environment for 8 h. The samples are cooled and placed in 5 mm diameter platinum pan. It is subjected to reaction in dry and wet environment at 1073 K by applying 100%-Ar and Ar-5%H₂ gas. Each reaction period is 48 h utilizing Thermo Gravimetric Analyzer, TGA to quantify the mass changes. After the reaction, the samples then characterized with Fourier Transform Infrared Spectroscopy, FT-IR and Field Emission Electron Scanning Microscopy, FE-SEM. The TGA result shows mass decreasing ratio of Cr₂O₃ in wet (PH₂O = 9.5x10⁵Pa) and dry environment is at a factor of 1.2 while parabolic rate at 1.4. FT-IR results confirmed that water vapor significantly broaden the peaks, thus promotes the volatilization of Cr₂O₃ in wet sample. FESEM shows mostly packed and intact in dry while in wet sample, slightly porous particle arrangement compare to dry. It is concluded that water vapor species decreased Cr₂O₃ protectiveness capability. © Published under licence by IOP Publishing Ltd.

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