292d A Study of Iron Sulfide Film Formation in H_2S Environments

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The precipitation of iron sulfide occurs widely both in natural systems and in corrosion products. Many types of iron sulfides may form, such as amorphous ferrous sulfide, mackinawite, cubic ferrous sulfide, troilite and pyrite. These iron sulfides have different stoichiometries of Fe and S and different crystal structures. Understanding the mechanism and kinetics of iron sulfides film formation is a complicated and important task.

Glass cell experiments were conducted to investigate iron sulfide film precipitation in H2S environments. Both carbon steel and stainless steel were used as the substrates to grow iron sulfide film. Weight gain/loss (WGL) method was used to investigate kinetics of iron sulfide film formation. Scanning Electron Microscopy/Energy Dispersive Spectrometry (SEM/EDS), X-ray Diffraction methodology (XRD), and X-ray Photoelectron Spectroscopy (XPS) were used to analyse the properties of iron sulfide film. The experimental results show that mackinawite was the predominant iron sulfide formed on the steel surface under the test conditions. Little mackinawite film formed on the stainless steel surface comparing to carbon steel. It was also found that ferrous ions forming film mainly come from Fe^{2+} released from the steel surface while not from Fe^{2+} provided by ferrous chloride in the bulk of the solution.