Effect of Rolling method and Sensitization treatment on the Microstructure and Passive Properties in 2101 Duplex Stainless Steel

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The manufacturing processes have an important influence on the corrosion resistance of duplex stainless steel. The present work is aimed to study the microstructure and passive properties in hot-rolled and cold-rolled 2101 lean duplex stainless steel with solid-solution or sensitization treatment. The microstructure of the samples was investigated by using optical microscope (OM) and XRD characterization. It has been found that the precipitated amounts of Cr₂N phase in cold-rolled samples are much more than that of hot-rolled samples. The defect and martensite also exist in the cold-rolled 2101 DSS. The chemical composition and electrochemical behavior of the passive film formed on the various specimens were further analyzed by the electrochemical impedance spectroscopy (EIS), Mott–Schottky and XPS analysis. Results indicate the solid-solution cold-rolled samples have a significant increased donor and acceptor densities and inhibition of Cr₂O₃ formed on the passive film, compared to the solid-solution hot-rolled samples. Moreover, the sensitized samples destroyed the Cr-containing protective passive film and possessed a less chromium oxide content than that of solid-solution samples. Especially, the sensitized cold-rolled 2101 had the enrichment of iron (III) oxides on the passive films. The difference of composition and carrier densities on the samples leads to the various corrosion resistance.

Keywords: duplex stainless steel; rolled; sensitization; passive film; EIS.

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