Corrosion Behavior of High Strength C71500 Cu-Ni Alloy Pipe in Simulated High Sulfide Polluted Seawater at Different Temperatures

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By studying the corrosion behavior of high strength C71500 Cu-Ni alloy pipe at the inlet and outlet of heat exchanger in simulated high polluted seawater at different temperatures, which could provide theoretical basis for improving the service life of the alloy. The corrosion mechanism of the alloy was determined by electrochemical techniques such as potentiodynamic polarization curve, electrochemical impedance spectroscopy (EIS) as well as cyclic voltammetry curve (CV) and the morphology and composition of corrosion products were analyzed by immersion test, SEM, EDS, XPS and XRD. The results show that the alloy exhibits activation polarization at all test conditions, the higher the solution temperature, the greater the corrosion rate. When the temperature reaches 35°C, the average corrosion rate of the alloy is stable at about 0.0121 mm/a. In the initial stage of corrosion, diffusion process could be observed. Corrosion products have a certain protective effect, the diffusion process disappears and the EIS shows only capacitive reactance arc with the prolong the immersion time. The addition of high concentration of Na₂S promotes the formation of Cu₂S and the redox process, thus accelerating the corrosion process. At relatively low temperature, the dominant process is Ni dissolution, while the content of Cu and S dissolving increase at high temperature. The thickness and compactness of corrosion products increase with the increasing temperature, which promotes to reach a relative stable corrosion rate. More sulfide species corrosion product could be detected at the low temperature, and the dissolution of copper is the main corrosion process at high temperature.

Keywords: C71500 Cu-Ni pipe; sulfide polluted; temperature; corrosion behavior; seawater

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