Influences of Thermomechanical Conditions on Corrosion Behavior of low-carbon steels in Artificial Seawater

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The unprecedented global warming process causes the shrinking of sea ice in the polar region every year; hence, in order to withstand the harsh environment of this region as well as to reduce the transportation cost, a large number of high-strength steels are required to build icebreakers. The main objective of the present study was to investigate the corrosion behavior of both water-quenched and air-cooled low-carbon steels in 3.5% artificial NaCl solution. It was found that after the corrosion of lamellar ferrites in pearlites and martensites, the remaining cementites aggravated the galvanic corrosion and the pitting corrosion in the matrix. Further, dislocation and the presence of large fractions of cementite in the matrix deteriorated the corrosion resistance property of the directly water-quenched sample. However, the air-cooling process significantly improved the corrosion resistance behavior of the sample steel.

Keywords: Corrosion, Electrochemical impedance spectroscopy, Low-temperature carbon steel, Thermomechanical controlled process, Quenching

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