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# The Role of Phase Morphology on the Corrosion Fatigue Mechanism in Marine Steel

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**Abstract :** The correct knowledge of corrosion fatigue mechanism in marine steel is very important. This is because it enables the design, selection, and use of steels for offshore applications. It also supports realistic corrosion fatigue life prediction of marine structures. A study has been conducted to increase the understanding of corrosion fatigue mechanism in marine steels. The materials investigated are normalized and advanced S355 Thermomechanical control process (TMCP) steels commonly used in the design of offshore wind turbine support structures. The experimental study was carried out by conducting corrosion fatigue tests under conditions pertinent to offshore wind turbine operations, using the state of the art facilities. A careful microstructural study of the crack growth path was conducted using metallurgical optical microscope (OM), scanning electron microscope (SEM) and Energy Dispersive X-Ray Spectroscopy (EDX). The test was conducted on three subgrades of S355 steel: S355J2+N, S355G8+M and S355G10+M and the data compared with similar studies in the literature. The result shows that the ferrite-pearlite morphology primarily controls the corrosion-fatigue crack growth path in marine steels. A corrosion fatigue mechanism which relies on the hydrogen embrittlement of the grain boundaries and pearlite phase is used to explain the crack propagation behaviour. The crack growth trend in the Paris region of the da/dN vs. ΔK curve is used to explain the dependency of the corrosion-fatigue crack growth rate on the ferrite-pearlite morphology.

**Keywords :** corrosion-fatigue mechanism, fatigue crack growth rate, ferritic-pearlitic steel, microstructure, phase morphology
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