Effect of Corrosion Surface Topography on Fatigue Life of Low Carbon Steel

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One of the main research areas of Metallurgical Engineering is associated with the estimation of fatigue life of atmospherically corroded metallic structural components. It has been studied extensively worldwide and most of the researchers in this area have focused on statistical analysis of fatigue strength of alloy steels and other metals deteriorated due to pitting corrosion. The scope of this work is focused on the fatigue behavior of low carbon steel, exposed to coastal-atmospheric corrosion which omits pitting. Studying the change in surface topography with exposure time, due to atmospheric corrosion is one of the two main objectives of this research. Evaluating the change in fatigue life of corroded samples with changing surface topography due to corrosion is the second objective. Fatigue life is taken as the number of cycles to failure, and it is evaluated by experimental and numerical methods (FEA). The surface topography is evaluated quantitatively using Scanning Electron Microscopy and 3D MountainMaps™ software. The quantitative data obtained on surface features are then represented in a finite element model to evaluate their fatigue performance using fatigue analyzing FEA software. The significance of this work is that it helps to explain the difference between simulated and experimentally determined fatigue life of atmospherically corroded low carbon steel, which can be ultimately used in estimating the life expectancy of corroded structural steel components.

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