Effect of a Nanostructured Coating on the Fatigue Response of Metastable Ti-15Mo Alloy through Fracture Mechanics Application

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This work evaluated the fatigue response of the biomedical metastable Ti-15Mo alloy with surface modified by TiO_2 nanotubes formation through the prediction of the size of a potential surface discontinuity that could result from the oxide layer brittleness and consequently generate crack propagation. This prediction was based on the fracture mechanics equations established in Fitness-For-Service (FFS-1) section of the American Society of Mechanical Engineers (ASME) Code. Fatigue tests of polished and coated specimens were performed in physiological media at 37°C, as an attempt to simulate the human body environment, following a stepwise load increase method. The application of fracture mechanics equations revealed that the nanostructured oxide layer should generate a circumferential crack of 5 μm depth in order to reduce the fatigue performance of the alloy. This prediction was experimentally confirmed with the fatigue tests for different coating thicknesses.