FATIGUE CORROSION BEHAVIOR OF NITI SHAPE MEMORY ALLOY

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Abstract

The fatigue process causes the protective passive film rapture, which accelerates the corrosion of metallic materials. The synergic interaction of fatigue and corrosion processes with variable thermal and mechanical loads cause the shorter fatigue lifetime. In this study, the thermomechanical fatigue of Nickel-Titanium shape memory alloy (SMA) undergoing thermally induced martensitic phase transformation in a physiological corrosive environment is investigated. The effect of the change in phases of Nickel-Titanium SMA on the electrochemical behavior at different load levels was characterized. Electrochemical techniques showed the global influence on the SMA surface during the change in crystallographic orientation and phase transformation due to the loading conditions. This change in crystallographic orientation affected the surface of Nickel-Titanium SMA locally. These local effects could be sensed by the global interfacial changes with electrochemical measurements, such as Electrochemical Impedance Spectroscopy (EIS), Open Circuit potential (OCP) and Linear polarization (LPR) methods.

The passive layer formation includes Ni and Ti oxide based composition following exposure in Ringer's solution. The increase in the loading parameter resulted in the breakdown of the passive layer while passivation stage could be reached due to the strain effect on the bonding or physical characteristics of the passive layer.

Keywords: Shape memory alloy; Corrosion fatigue; Martensitic phase transformation