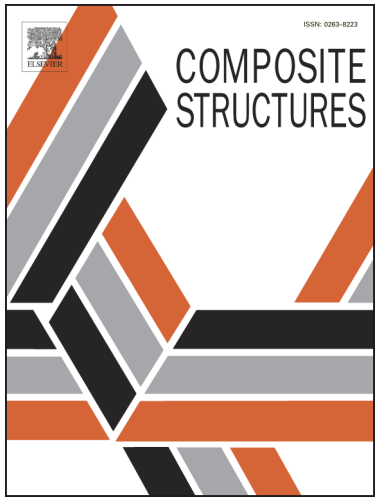

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Fatigue behavior of glass-fiber-reinforced epoxy composites embedded with shape memory alloy wires

Zhenqing Wang[a], Lidan Xu[a], Xiaoyu Sun*[1a], Mingfang Shi[a], Jingbiao Liu[a]

[a] *College of Aerospace and Civil Engineering, Harbin Engineering University Harbin 150001 China*

Abstracts: The tensile fatigue behavior of glass-fiber-reinforced epoxy (GF/epoxy) composites embedded with shape memory alloy (SMA) wires prepared by vacuum assisted resin infusion (VARI) processing was investigated. The experiments were performed under cyclic tensile load. The damage mechanism of SMA composites under different stress levels of cyclic loadings was revealed. The fracture surface and fatigue failure modes of the specimens were examined and analyzed according to the damage mechanism under different stress levels. The stress-number (S-N) curves, the residual strength and residual stiffness of specimens were calculated after the experiment. The results show that the fatigue life of SMA composites is more than twice higher than GF/epoxy composites. Microstructural analysis using the scanning electron microscopy (SEM) technique was conducted on fractured surfaces to fully understand the failure mechanism. The fatigue failure modes in SMA composite laminates were revealed.

Keywords: tensile fatigue behavior, shape memory alloys, damage mechanism, residual strength, residual stiffness.

1. Introduction

In recent years, smart materials and structures or intelligent material systems have attracted increasing interests because of their enormous scientific and technological significance [1]. Fiber reinforced polymer (FRP) composites are very sensitive to internal damage usually caused by external dynamic mechanical behaviors, such as fatigue load [2].

Shape memory alloys (SMAs) possess excellent corrosion resistance, good fatigue properties, and ability to dissipate energy since the loading and unloading trajectories do not coincide and produce a hysteresis loop

*Corresponding author: College of Aerospace and Civil Engineering, Harbin Engineering University, Harbin 150001, China. Email: sunxiaoyu520634@163.com.