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SUPPRESSION OF TRANSVERSE CRACKS IN CFRP LAMINATES WITH EMBEDDED SMA FOILS

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ABSTRACT

The present paper experimentally studies the microscopic damage in the Shape Memory Alloy (SMA) foil-CFRP composite system, and proposes an appropriate transverse crack evolution model with Monte Carlo simulation based on the Weibull-Poisson flaw statistics and a modified shear-lag model considering the stress transfer due to the phase transformation. The predictions are found to have good agreement with the experimental results, and show that recovery stresses due to SMA foil suppress the multiplication of the transverse cracks.

KEYWORDS

Composite, Shape Memory Alloy, Transverse crack

INTRODUCTION

SMAs with shape memory mechanism and psuedoelasticity has been widely used as actuators in smart material and structural systems. Especially, in order to suppress the microscopic damage in the composite, the SMA-FRP composite system has been expected to be useful in the engineering application including the aerospace field. Although many studies for SMA composites have been reported, most of them address the SMA wire reinforced composite [1,2]. In a view of preventing the microscopic damage occurring in the composite, SMA foil is considered to be more effective than SMA wire.

In the present paper, we experimentally observe the microscopic damage in the composite and propose an appropriate transverse crack evolution model with Monte Carlo simulation based on the Weibull-Poisson flaw statistics and a modified shear-lag model considering the stress transfer due to the phase transformation. The predictions are found to have good agreement with the experimental results.