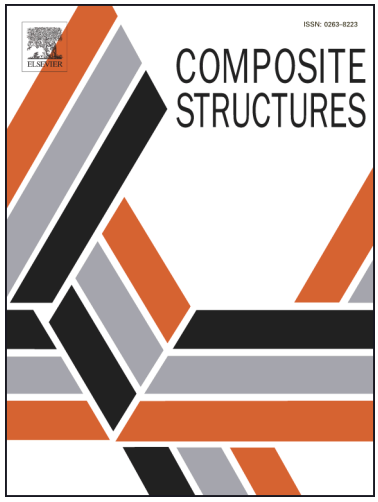

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Novel Carbon Nanotube Interlaminar Film Sensors for Carbon Fiber Composites under Uniaxial Fatigue Loading

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ABSTRACT

This paper discusses the real-time sensing behavior of carbon nanotube film sensors interleaved between cross-ply carbon fiber-epoxy laminate under uniaxial fatigue loading conditions. The carbon nanotube film integrated cross-ply specimens were subjected to tension-tension fatigue load (R=0.5) up to 10,000 cycles, and the electrical-mechanical response of the sensors was monitored *in situ*. The damage progression of the composite laminate was monitored during fatigue loading through non-destructive acoustic emission and microscopic edge replication techniques. The damage state of the laminate was also characterized using ultrasonic c-scan and x-ray computed tomography. The carbon nanotube film sensors are highly capable of strain sensing under fatigue loading. As damage accumulates in the fiber composite through the formation of matrix cracks and delamination the shift in internal stresses can be utilized to monitor damage progression *in situ*. In particular, the quasi-static piezoresistive response of the laminate at low strains becomes increasingly negative and can be utilized as an indicator of damage.

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