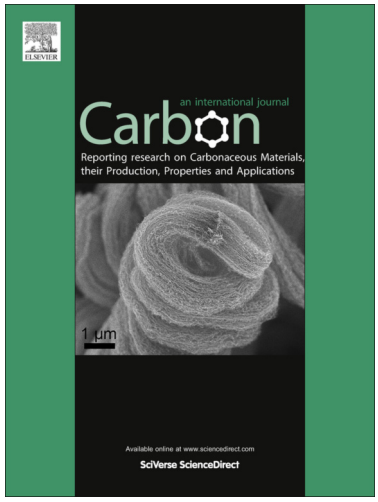

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Investigation of Electro-Mechanical Behavior of Carbon Nanotube Yarns DuringTensile Loading

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ABSTRACT

Carbon nanotube (CNT) yarns were evaluated for sensor applications by measuring electrical properties during uniaxial tension loading. Mechanical properties (tenacity and failure strain) and electrical properties (resistivity and gauge factor) were investigated and statistical distributions for these properties were obtained. Cyclic loading test resultsshowed that permanent strain after unloading exists and that the resistance at zero load increases linearly with permanent strain. Furthermore, the relative resistance change during loading was found to be linear with strain. Although mechanical properties of CNT yarns exhibited a significant statistical variation, the resistance was found to have much less statistical variation making them good candidates as sensors for structural health monitoring in composites.

1. INTRODUCTION

Multifunctional properties of CNTs [1] include high specific stiffness and strength combined with high levels of thermal and electrical conductivity. CNTshave been used extensively as fillers in composites. Several physical and chemical properties of CNTs are strongly coupled and this coupling enables novel sensing and actuating applications [2]. CNT based materials exhibit a strong dependence of resistance on mechanical strain (i.e. piezoresistivity). The fundamental mechanism behind CNT based piezoresistive materials is the change in the CNT-CNT tunneling distances with applied strain [3-4].