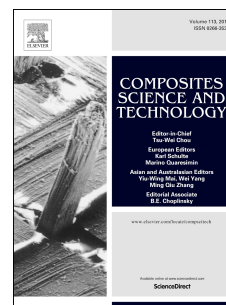


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Electrical Actuation and Shape Memory Behavior of Polyurethane Composites Incorporated with Printed Carbon Nanotube Layers

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Abstract

In this study, a novel digitally controlled spraying-evaporation deposition modeling process was used to deposit carbon nanotube (CNT) layers on shape memory polymer (SMP) films. This system is able to produce CNT layers with variable thicknesses and arbitrary patterns on defined locations. The study on the electrical properties of composite films revealed that the composites with 50 CNT layers exhibited the lowest sheet resistance of 28.7Ω/sq. Accordingly, the resistive heating performance of the fabricated composites was investigated at different power densities. The maximum surface temperature can be adjusted by simply tuning the numbers of printed CNT layers. Particularly, the even temperature distribution or temperature gradient could be realized on the surface of composites through modifying the design of printed CNT patterns. The study on the shape memory effect of the CNT/SMP composites indicated that the CNT/SMP composites can be actuated by the resistive heating of the printed CNT layers without an external heater. The shape recoverability of the composites was approximately 100% taking 30s under 40V. It is worth noting that through programming the number of printed CNT layers at different locations, the shape recovery rate could be controlled and localized actuation with the desired recovery ratio was achieved. The high efficiency of heating coupling with wide

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