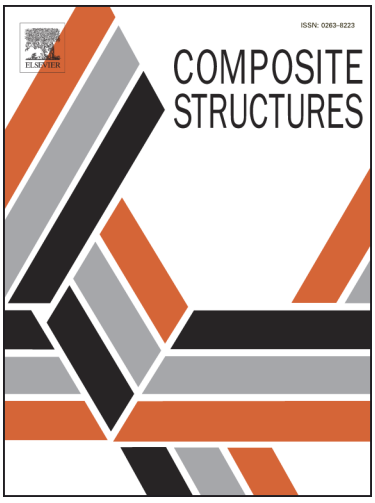

Integrative hinge based on shape memory polymer composites: Material, design, properties and application

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PII: S0263-8223(18)31217-0
DOI: https://doi.org/10.1016/j.compstruct.2018.08.041
Reference: COST 10091

To appear in: *Composite Structures*

Received Date: 1 April 2018
Revised Date: 25 June 2018
Accepted Date: 14 August 2018

Please cite this article as: Liu, T., Liu, L., Yu, M., Li, Q., Zeng, C., Lan, X., Liu, Y., Leng, J., Integrative hinge based on shape memory polymer composites: Material, design, properties and application, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.08.041

Integrative hinge based on shape memory polymer composites: material, design, properties and application

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Abstract

6. Self-deployable structures based on shape memory polymer composites (SMPCs) have the capability of self-deploy, light weight and high load-bearing. This paper presents the detail of an integrative hinge fabricated by carbon fiber reinforced shape memory epoxy composites in the sequence of material selection, structure design and manufacture, material and structure experiments, and application. DMA experiments have been conducted to figure out the temperature sensitivity of SMP. The temperature dependent elastic modulus and strength of SMPC were determined by tensile experiments. Results from three point bending tests and shape memory recovery tests verify the variable stiffness of the integrate SMPC hinge under different temperatures and superior shape memory properties. Strain distribution during bending process are obtained from both digital image correlation (DIC) measurements and ABAQUS simulation, showing good consistency with each other. To compare the modal characteristics with traditional SMPC hinge, modal testing and computation have been designed with free boundary condition. It can be found that the integrative SMPC hinges have the characteristics of improved reliability and performance, and higher post-deployment stiffness and strength, when compared to traditional SMPC hinges. Finally, prospective applications of the self-deployable structure have also