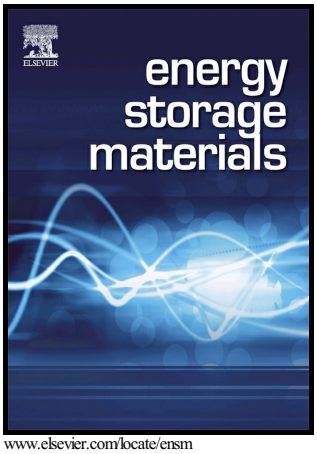

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PII: S2405-8297(17)30503-2
DOI: https://doi.org/10.1016/j.ensm.2017.12.028
Reference: ENSM284

To appear in: *Energy Storage Materials*

Received date: 8 October 2017
Revised date: 27 November 2017
Accepted date: 30 December 2017

Cite this article as: Jie Yang, Guo-Qiang Qi, Rui-Ying Bao, Kongyang Yi, Menglin Li, Lan Peng, Zhi Cai, Ming-Bo Yang, Dacheng Wei and Wei Yang, Hybridizing graphene aerogel into three-dimensional graphene foam for high-performance composite phase change materials, *Energy Storage Materials,* https://doi.org/10.1016/j.ensm.2017.12.028

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ABSTRACT

Three-dimensional (3D) graphene foam (GF) produced by template-directed chemical vapour deposition (CVD) has shown great potential for applications in composite phase change materials (PCMs) with enhanced thermal conductivity and graphene aerogel has been proved to be effective supporting scaffold to improve the shape-stability of orgnic PCMs. Here, hybrid graphene aerogel (HGA) is encapsulated in GF framework to obtain a 3D GF/HGA (GH) hybrid microstructure via combined self-assembly and CVD techniques. The thermal conductivity of paraffin wax (PW)/GH composite PCMs increases by 574% and 98% compared with pure PW and PW/GF composite PCMs, respectively. Meanwhile, PW/GH composite PCM exhibits better shape stability than PW/GF composite PCM, high thermal energy storage density, good thermal reliability and chemical stability. PW/GH composite PCMs also realize efficient light-to-thermal energy conversion and storage owing to the excellent photoabsorption. This study sheds light on the development of the composite PCMs with good comprehensive properties, which are potentially to be used widely in energy storage systems.