Electronic Supplementary Material (ESI) for Nanoscale.

Electronic Supplementary Information for

Solar-thermal conversion and thermal energy storage of graphene foam-based composite

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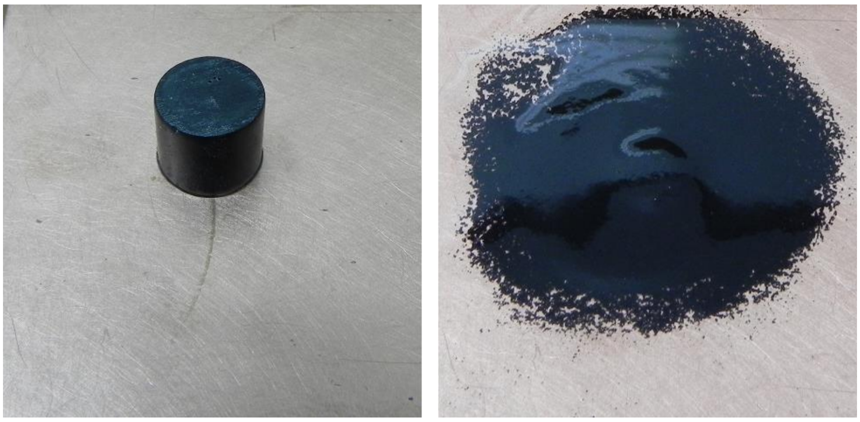

Figure S1. Simple complex of the graphene-wax mixture (i.e., no 3D foam structure of graphene) placed on a hot plate with temperature of 100^oC. The weight fraction of graphene in the complex mixture was 3%. At the elevated temperature, such a complex quickly melted and collapsed, indicating its poor form stability.

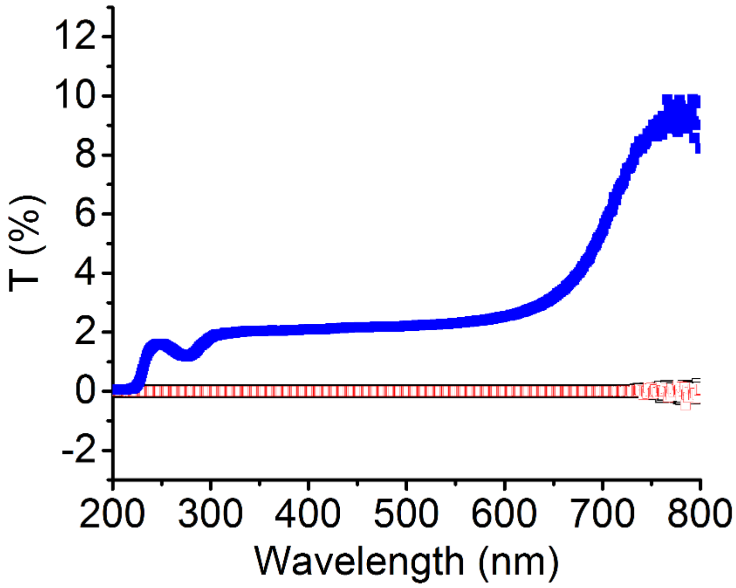

Figure S2. a) Transmittance spectra of the graphene foam (red), composite (black), and wax (blue). The sample thickness was ~ 1mm.

To estimate the thermal conductivity of the composite, pellet samples of the composite, pristine wax, and the simple complex mixture of graphene and wax (i.e., no 3D foam structure of graphene) with the same thickness of 3.2 mm were prepared and placed into the holes with matching size made in a thermally insulating polystyrene foam. The top surfaces of these samples were exposed to the simulated solar light with the light intensity of 1000Wm^{-2}, and the temperatures of the top surface and the bottom surface of the samples were recorded by the IR camera, as shown in Figure S3a. Before the measurement, the both surfaces of the samples were coated with a thin layer of graphite in order to improve light absorption. As shown in Figure S3b-d, under the light irradiation with the intensity of 1000 Wm^{-2}, both the top and bottom surfaces of all three samples reached steady-state temperature after 30 minutes, and the steady-state temperature of the top surfaces were similar for all samples. It can been that the composite sample showed a small temperature difference (ΔT) of 5.2^oC between the top and bottom surfaces, while the temperature difference between the top and bottom surfaces for the pristine wax, and simple graphene-wax complex were 10.4^oC and 8.6^oC, respectively. The low temperature difference of the composite indicates its enhanced thermal conductivity. By using the Fourier equation (Equation S1)[1], the thermal conductivity can be estimated, given the heat flux and the temperature gradient in the material.

$$Q=k\Delta T/\Delta X \qquad \text{(S1)}$$

Where Q is the heat flux (1000 Wm^2), k is the thermal conductivity, and $\Delta T/\Delta X$ is the temperature gradient across the sample.

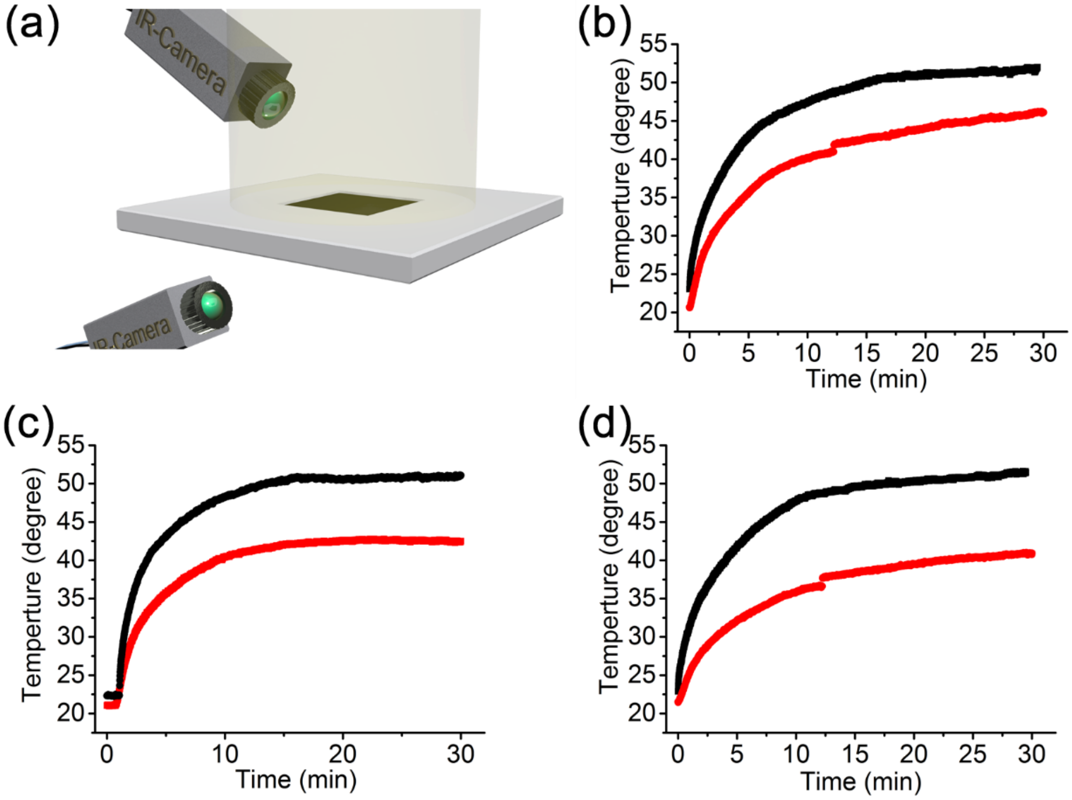

Figure S3. a) Schematic illustration for the estimation of the thermal conductivity. b-d) time-course of the temperature of the top surface (black curves) and bottom surface (red curves) of the composite (b), graphene and wax mixture (c), and pristine wax (d).

Supplemerntary Reference:

1. H.Ghasemi, G. Ni, A. M. Marconnet, J. Loomis, S. Yerci, N. Miljkovic and G. Chen, *Nat. Commun.*. 2014, **5**, 4449.