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Vertically-oriented Graphene Growth at Low Temperature for Solarthermal Applications

Abstract
Compared with the conventional two-dimensional graphene, vertically-oriented graphene (VG) nanosheets [1], composed by few-layer graphene, have also been synthesized via a plasma-enhanced chemical vapor deposition (PECVD) route on metal or dielectric substrates. Many unique properties, including large amount of exposed edges, non-stacking geometry, and a large surface-to-volume ratio were detected for such graphene nanosheets. In particular, different application aspects with regard to their 2D counterparts have been developed [2]. By a direct-current -PECVD system at 580 °C, the direct synthesis of VG nanosheets on traditional soda-lime glass or other glass substrates can be achieved, which is right below the softening point of normal glass, and featured a scale-up size ~6 inches. Particularly, the fabricated VG nanosheets-glass hybrid materials at a transmittance range of 97%–34% exhibited excellent solarthermal performances, reflected by a 70%–130% increase in the surface temperature under simulated sunlight irradiation. We believe that the graphene glass hybrid materials have great potential for use in future transparent “green-warmth” construction materials.

References

[1] Bo, Z.; Yang, Y.; Chen, J. H.; Yu, K. H.; Yan, J. H.; Cen, K. F. Nanoscale, 5 (2013) 5180–5204.
[2] Zhang, Z; Lee, C. S.; Zhang, W. Advanced Energy Materials, 7 (2017) 1700678.

Figures

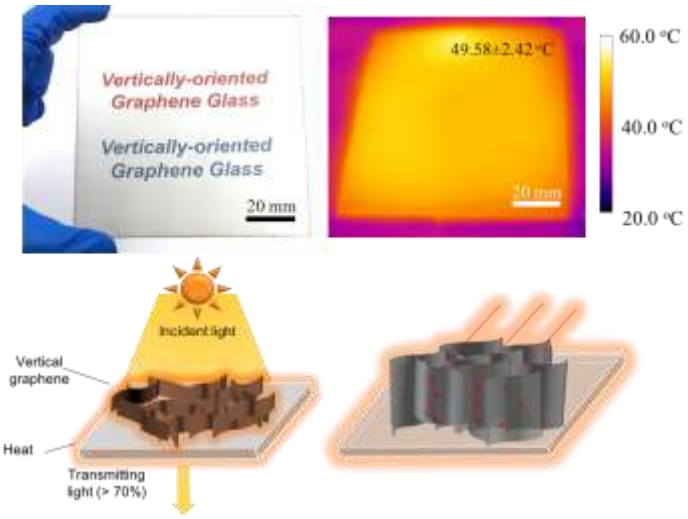

Figure 1: The schematic illustration of VG-glass materials for solarthermal applications