

Graphene oxide assisted hydrothermal carbonization of carbon hydrates

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Abstract

Biomass is a cheap, ecofriendly and renewable raw material for the production of functional carbonaceous materials. Hydrothermal carbonization (HTC) of biomass typically produces carbon materials that are insulating. Using simple carbon hydrates such as glucose and cellulose as a model system for biomass, here we demonstrate that graphene oxide (GO) sheets can promote HTC conversion. Adding a very small amount of GO to glucose (e.g., 1:800 weight ratio) can significantly alter the morphology of its HTC product, resulting in more conductive carbon materials with higher degree of carbonization. HTC treatment of glucose is known to produce a dispersion of micron sized carbon spheres. In the presence of GO, HTC treatment results in dispersed carbon platelets of tens of nanometers in thickness at low mass loading level, and free-standing carbon monoliths at high mass loading levels. Control experiments with other carbon materials such as graphite, carbon nanotubes and carbon black show that only GO has significant effect in promoting HTC conversion, likely due to its good water processability, amphiphilicity and two-dimensional structure that may help to template the initially carbonized materials. GO offers an additional advantage in that its graphene product can act as an *in-situ* heating element to enable further carbonization of the HTC carbon monoliths upon microwave irradiation. Similar effect of GO is also observed for the HTC treatment of cellulose.

Figure

