

High surface area reduced graphene oxide via L-ascorbic acid treatment

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Graphene has attracted significant attention due to its excellent chemical and physical characteristics. Graphene materials prepared from graphene oxide (GO) by reduction have been investigated because of their potential to scale up. There are diverse physicochemical methods to reduce GO such as UV-light irradiation,¹ thermal,² hydrazine,³ sodium bisulfate,⁴ and L-ascorbic acid (AA) treatments.⁵ Unfortunately, the reduction of GO generally accompanies the stacking of graphene sheets, which results in a lower surface area than is desired for graphene structures (2,630 m²/g).^{2,6}

In this research, we investigated the reduction process while suppressing the stacking of graphene sheets using AA. We synthesized reduced graphene oxides (rGOs) fixing the mass ratio in 1:5 (GO:AA) at 25 (rGO₅₋₂₅), 35 (rGO₅₋₃₅), 50 (rGO₅₋₅₀), and 80 °C (rGO₅₋₈₀), reaching specific surface areas as higher as 403 m²/g. All rGOs showed similar morphology and Raman spectra; however, they showed different oxygen contents, physisorption performances (Figure 1a), surface areas (Table 1), and XRD patterns (Figure 1b). Our experiments demonstrate that AA not only acts as a reducing agent, but also as a spacer that prevent the stacking of graphene sheets. Besides, by carrying out a time-course mechanistic study on rGO₅₋₂₅, we can propose a successive grafting-reduction mechanism.

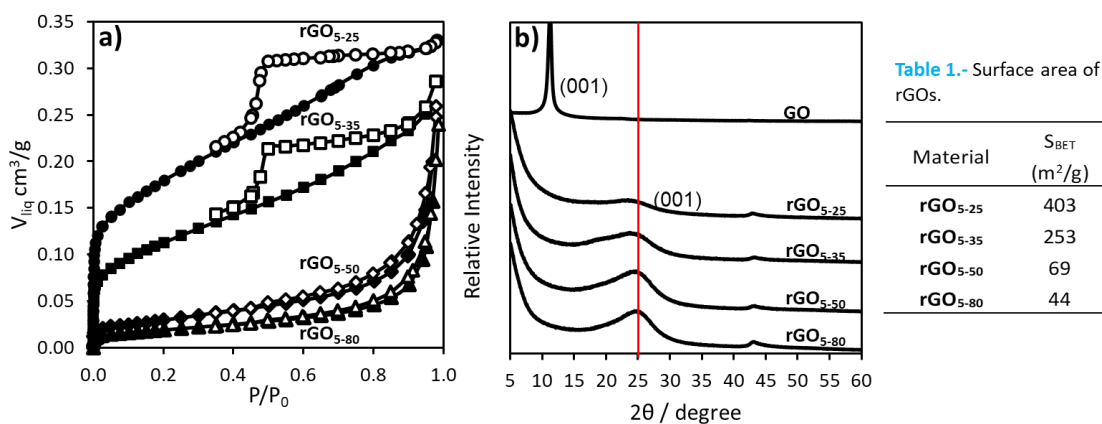


Figure 1: a) Nitrogen adsorption-desorption isotherms at 77 K and b) XRD patterns of rGOs synthesized at a fixed AA mass ratio of 5 at different temperatures.

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