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Graphene Oxide acidity modifications

Graphene oxide (GO) as prepared by the "Hummers method"[1] is a solid acid with up to 2 mmol acid sites per gram. The acid sites are of various nature, but mostly carboxylic and hydroxylic groups (Fig.1). GO and GO-derivatives have been reported to have potential for a range of applications, such as corrosion protection, water treatment, composites, lubricants, energy storage, photo-catalysts, sensors, sports equipment, elastomers and load speaker membranes. For some of these applications, pH adjustment can be needed. In this study, we review how acidity can be adjusted by washing and by neutralization with bases, and how this affects fundamentally important properties such as dispersibility. Titration curves for "standard" GO and "water washed" GO are shown in Fig. 2, the standard GO having about 1.4 mmol acid sites per gram and the water washed GO having about 0.4 mmol acid sites per gram. From an industrial perspective, concerns, apart from relevant chemistry are costs, availability and hazards. Costs will inevitably come down with increased production volumes, to as little as 2 - 3 % of today's price, according to our estimates. The keys to cost reduction are economy of scale and automation.

References

1. *Hummers, William S.; Offeman, Richard E. (March 20, 1958). "Preparation of Graphitic Oxide". Journal of the American Chemical Society.* ***80*** *(6): 1339.*

Figures

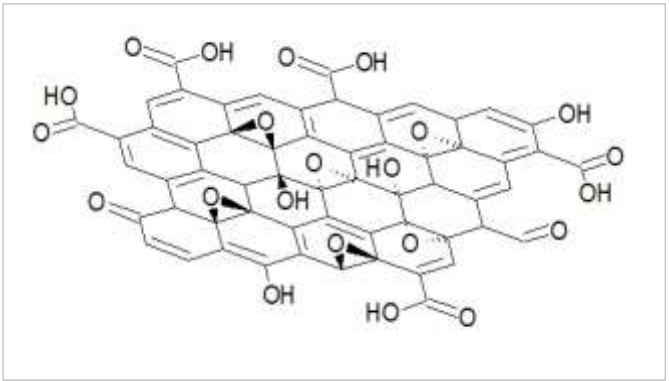

Figure 1: Schematic illustration of functional groups on GO.

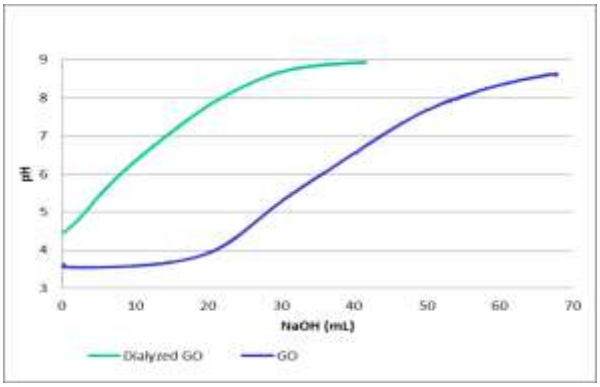

Figure 2: Titration curves for as produced GO compared to water-washed GO, 0.025 % dispersions titrated with NaOH.