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Emerging Industrial Applications of Graphene Oxide

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Abstract

Graphene oxide (GO), also known as graphitic oxide, has the advantage over other graphene type materials of being easy to modify to satisfy a wide range of requirements. GO is most often prepared by the so called Hummers method[1] or modifications thereof. As producer of GO and GO-derivatives in Kg-quantities with customers on all five continents we have in recent years gained valuable insight in emerging industrial applications world-wide.

As a pure compound, GO is a highly oxidized solid acid easily dispersible in water as single layers with a thickness of 0.8 – 1 nm. It can be reduced to become more or less graphene-like rGO and both GO and rGO can be de-acified, functionalized, and N-doped to obtain new properties.

It is well established that GO, when applied correctly, has a stabilizing effect on the sulfur cathode in LiS-batteries. In our Graphene Batteries AS, we are obtaining excellent results in terms of cyclability, and we now pursue this approach further having access to Abalonyx' versatile GO product portefolio.

Corrosion protection is the first application of GO now being industrialized by the Swedish company Provexa AB, promising strongly reduced corrosion to steel products like automobile parts, heat exchangers, pipelines etc. Other promising developments are seen in membranes, water treatment, composites, electronic components and sports equipment. Abalonyx, being a leading graphene oxide producer, is continuously monitoring emerging applications with an ambition to provide optimized GO-products to any industrial end-user. From the industrial end-user perspective, cost, reliable availability, possible hazards and shelf life are the most important concerns apart from relevant chemistry. Industrial production costs are strongly related to production volumes. Availability is related to proven production capacity, preferably by more than one producer with proven consistency regarding quality. Possible hazards related to production of GO have now been solved. Since GO is a metastable compound it undergoes continuous changes over time when stored, representing a challenge for users. However, analysis of GO produced 7 years ago shows it is still fully dispersible into single layers. We are now performing a long term study to identify optimum storing conditions and document exactly the changes that occur (Figure 1).

References

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

Figures

Figure 1: Samlpes of five different graphene oxide products stored at -18 °C, 5 °C and room temperature since May 2018, to be analyzed regularly over the coming 600 years!