Graphene Oxide: Optimisation for Industrial Applications

15th Anniversary HVM 2017 & Graphene New Materials Conference

2-3 November 2017 Cambridge, UK www.cir-strategy.com/events





Founded in 1845, William Blythe manufactures inorganic speciality chemicals for a wide variety of applications

We are a chemistry innovation business supplying differentiated, technically advanced specialty products



Global Sales to more than 40 countries





Locations



Site Overview

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- William Blythe runs an extensive R&D programme focussing on advanced materials
- Graphene oxide has the potential to impact multiple sectors through several functionalities
- Manufacture fits with William Blythe's core capabilities
 - Experts in redox chemistry
 - Expertise in controlling and measuring the physical properties of products
 - Well developed Process Safety Management System to allow the safe scale up of hazardous processes and a top tier COMAH site allows use of hazardous chemicals



Graphene Oxide at William Blythe

- Development programme began in 2015, focussing on the Hummers synthesis
- Optimisation of process has led to a scalable method for manufacturing graphene oxide from graphite, tuned for dispersability





GOgraphene

- Online webshop launched in August 2016
- Designed to supply researchers (academic and industrial) with graphene oxide products
- Researchers have confidence in consistent supply for their work
- Purchase avoids hazardous synthesis
- Products currently available:
 - Freeze dried powder
 - Flake

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- 1% aqueous dispersion
- www.go-graphene.com







Tuning Graphene Oxide Functionality

Is it realistic to expect the same grade of material to be appropriate in all potential applications?

- Both the physical and chemical properties could impact the material compatibility and performance
- William Blythe is developing capabilities to tune graphene oxide for the application is will be used in
- Working together with customers, William Blythe will develop application specific grades of graphene oxide





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William Blythe is working to develop a suite of capabilities to optimise the control of the chemical characteristics of their graphene oxide according to customer requirements

Oxygen Content	What? Control of C / O ratio Why? Affects how different material is to graphene
Oxygen Functionality	What? Control over the oxygen functional groups present Why? Impacts the electronic properties when reduced
Surface functionalisation	What? Addition of non-oxygen functional groups Why? Can lead to different material properties

By developing capabilities to control the physical properties of graphene oxide, William Blythe will be able to optimise their graphene oxide according to customer requirements

Lateral Sheet Dimensions	What? Control of sheet size distribution Why? Impact on performance and compatibilization
Bulk Density	What? Optimization of the density of solids Why? Can impact on handling procedures
Dispersion Concentration	What? Control of material content in dispersions Why? Some applications require low energy inputs to achieve full dispersion



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Reliable Material Supply





Connected to our customers, Ready for your challenge



Excellence in chemistry