Integrated Graphene™

The Graphene Family *Explained*

A more detailed answer to the question ‘What is Gii, and how can it work for me?’

Introduction

Chances are you've heard about graphene – the wonder material first discovered by Geim & Novoselov at the University of Manchester in 2004. Perhaps you've read a news article about someone claiming to have solved the problems associated with manufacturing graphene.

While many of these discoveries have proved to be false dawns for the advancement of graphene, the arrival of Gii™ finally offers a scientifically proven and cost-effective means of manufacturing graphene at scale. Patented by Integrated Graphene, Gii™ is the most effective modification of this wonder material to date, with the potential to transform multiple industries and sectors.

Graphene in a nutshell

Graphene is a multi-purpose material composed of a layer of carbon atoms, one atom thick, arranged in a hexagonal matrix. Graphene is the building block of Graphite (like the tip of your pencil). The material is thin, strong and an excellent conductor of heat and electricity, among many other significant properties.

Around the world, many forms of graphene are being produced in different types and grades. These graphene types have varying percentage purity ratings and different levels of manufacturability and cost.

Three approaches to manufacturing

Gii™ 3D graphene foam grown on a substrate

Patented by Integrated Graphene, this is the most effective and efficient manufacturing method in terms of producing quality and least variability, economically at proven volume scale.

CVD - Chemical Vapour Disposition

This process deposits thin films on specific substrate surfaces. This technique is well known and produces quality product but results in low yields and complications from transfer from original manufactured substrate This limits its applications.

Exfoliation/Cleaving

This process which involves cleaving the graphite into graphene is a lot more unstable due to the need for high temperatures, mechanical stresses and harsh chemicals. Although it is less expensive than other methods to produce in quantity, it creates a lower quality of graphene, restricting its use as an additive to composites.

Commercially available forms of graphene

Gii™: 3D carbon scaffold

A 3-dimensional carbon-based nanomaterial produced using our proprietary patented method, Gii™ has none of the associated supply chain limitations of CVD Graphene.

Gii™ has a unique patented process that can be produced on almost any substrate and, crucially, in commercial quantities. Measured at 98% purity, it is high quality and customisable.

One of the most common difficulties faced with graphene is the use of toxic chemicals in the manufacturing process. However, with Gii™, no chemicals are required.

Unlike other forms of graphene, Gii's manufacturing has little waste, resulting in an efficient material applicable in many fields including medical diagnostics, energy storage, and gas and pressure sensing.

Pristine graphene 2D

This is graphene in its original pure unoxidized form. Although it is superior to graphene oxide, it is not easily available, limiting its use in applications. Where it is available, it's used as an additive, designed to be blended with other materials.

Reduced graphene oxide

Closer in form to pristine graphene, reduced graphene oxide removes the oxygen molecules leaving only a residue of oxygen. It contains more imperfections than graphene from graphite and is both costly and difficult to manufacture as a quality product.

Graphene Quantum Dots

Unlike the other Graphene family, they are zero dimensional. They have different optical and electronic properties to Graphene. However, this route is unlikely to hit mainstream manufacturing due to its raw source of mined coal.

Functionalised graphene

Functionalised graphene is modified by chemical oxidation, covalent or non-covalent doping to render different properties such as composition, size, shape, and structure. Examples of functionalised graphene include graphene oxide and graphene nano ribbons.

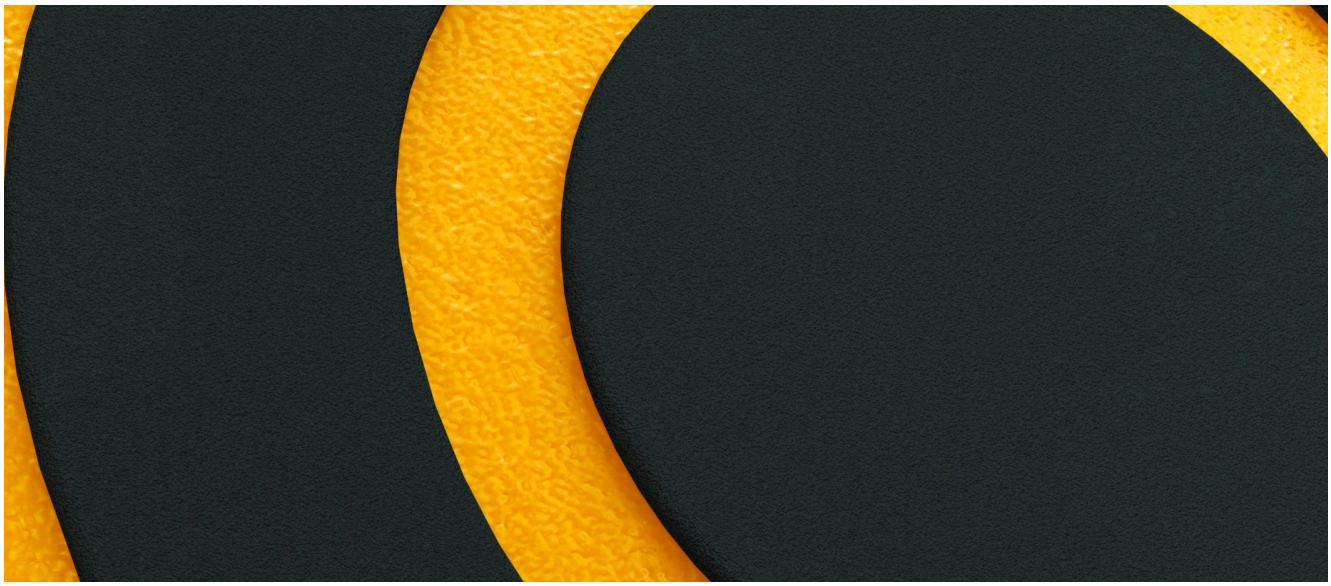
Graphene oxide 2D

Graphene oxide is the oxidised form of graphene, containing the functionalised oxygen groups. As graphene oxide is dispersible in water, it is relatively easy to use. However, this version is difficult and costly to manufacture through chemical vapour disposition (CVD). It is non-conductive which limits its potential applications.

Properties of Gii™

The scale of Gii ™ 3D electrochemical surface is unparalleled in other graphene forms, resulting in a wide variety of performance properties:

High Electrical and Thermal Conductivity	Field Effect Transistor (FET)	Triboelectric Properties	Antifouling
Magnetics Hall Effect	High Porosity	Lightweight	High Chemical Resistance



Applications of Gii™

Gii™ applications today

Gii Sens™ Our Human Diagnostic Biosensors driven by the mission to make health measurable, cost effective at the point of need. These are electrochemical electrodes made with our novel 3D Graphene, Gii ™. Disposable sensors that allow for one step assays without the need for pre-treatments and Gii - Sens+™ our pre-functionalised electrode with either NHS or COOH.

Energy Storage Supercapacitors – Gii Cap™ Our flat flexible power storage solution allowing smaller lighter better performing wireless voice enabled wearables. Enabling the eternal life of IOT devices, reducing, or eliminated batteries, enabling endless power source systems.

Possible applications of Gii™

Gii® technology offers the possibility to have highly sensitive, smaller form fit, flexible or rigid gas, magnetic and pressure sensors which are durable, economic, and scalable.

Another phenomenal property of Gii™ is as Triboelectric Nanogenerators (TENGS) which behave as energy harvesting power sources for autonomous sensors. This paves the way for example applications such an autonomous pressure sensing platform for anonymous room occupancy monitoring in smart buildings.

The highly tuneable 3D surface area of Gii™ lends itself well to chemical catalysts.

Due to the push of net zero, there are demands in reducing energy in manufacturing processes that are commonly high energy intensive industries such as pharmaceutical and chemical.

Gii™ may be able to support these initiatives.

This is an exciting novel material leading to many exciting application spaces.

- Hydrogen Storage
- Heat Dissipation
- Wearable Electronics

And many more…

To find out more about the power of Gii™ and potential applications for your specifications, please visit: integratedgraphene.com

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