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exfoliated-graphene-production-using-electrochemistry-for-simultaneous-

Infinity Turbine LLC

Exfoliated Graphene Production Using Electrochemistry for Simultaneous Energy Storage

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Graphene

PDF Version of the webpage (first pages)

https://infinityturbine.com/exfoliated-graphene-production-using-electrochemistry-for-simultaneous-energy-storage-by-infinity-turbine.html

Exfoliated Graphene

Under development using electrochemistry as a side of the Salgenx flow battery is making graphene.

There are many similarities and the use of sodium (Na) to exfoliate graphene from graphite.

Na is harvested during the Salgenx Flow Battery charging process.

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Electrostatic Pulling Using Ferrofluid

Under development is using electrostatics (similar to a laser printer) to exfoliate layers.

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What are the various methods to make graphene

Graphene is a highly versatile and exciting material that has been found to have numerous applications in fields such as electronics, energy, and medicine. It is a thin layer of carbon atoms arranged in a hexagonal lattice, with unique mechanical, electrical, and optical properties. The methods for making graphene have evolved over time and are continually improving.

One of the earliest methods for producing graphene was the mechanical exfoliation method, also known as the Scotch tape method. This method involves using adhesive tape to peel off layers of graphite until a single layer of graphene is obtained. While this method is simple and easy to perform, it is also time-consuming and produces small quantities of graphene.

Chemical vapor deposition (CVD) is another method used to produce graphene. In this method, a thin film of metal, typically copper, is used as a substrate. A hydrocarbon gas, such as methane or ethylene, is then introduced into a chamber where the metal substrate is heated to high temperatures. The carbon atoms from the gas then settle onto the substrate, forming a layer of graphene. This method is highly scalable and can produce large quantities of high-quality graphene.

Another method for producing graphene is the reduction of graphene oxide. Graphene oxide is a derivative of graphene that contains oxygen groups attached to its surface. The reduction process involves removing these oxygen groups, resulting in the formation of graphene. This method is relatively simple and can be performed using a variety of reducing agents, including hydrazine and sodium borohydride.

Liquid-phase exfoliation is another method used to produce graphene. In this method, graphite is suspended in a liquid, typically a solvent or surfactant, and then subjected to high-intensity sonication or shearing. The shear forces acting on the graphite cause it to exfoliate into individual layers of graphene. This method is highly scalable and can produce large quantities of graphene in solution.

In conclusion, the various methods for producing graphene have different advantages and disadvantages depending on the application and desired outcome. Mechanical exfoliation is simple but time-consuming and produces small quantities of graphene. CVD is highly scalable and produces high-quality graphene, but requires specialized equipment. Reduction of graphene oxide is relatively simple and versatile, while liquid-phase exfoliation can produce large quantities of graphene in solution. The continued development of these methods will further expand the applications of graphene in various industries.

What is a continuous method of making graphene from graphite

A continuous method of making graphene from graphite is a process where graphene is produced in a continuous flow or stream, rather than in batches. One such method is the electrochemical exfoliation method.

In this method, a graphite electrode is immersed in an electrolyte solution, which serves as a medium for the electrochemical reactions to occur. An electrical potential is applied across the graphite electrode and a counter-electrode, causing the graphite to exfoliate into graphene sheets. The graphene sheets are then collected from the solution.

This method is scalable and can produce large quantities of graphene continuously. The thickness and quality of the graphene sheets can be controlled by adjusting the electrochemical parameters such as the applied potential and the electrolyte composition. The method is also relatively low cost and can be performed using readily available materials and equipment.

Another continuous method of making graphene is the microwave-assisted exfoliation method. In this method, graphite is mixed with a solvent, such as water or ethanol, and subjected to microwave radiation. The microwave radiation causes the graphite to heat up and exfoliate into graphene sheets. The graphene sheets are then collected from the solution.

This method is also scalable and can produce large quantities of graphene continuously. The thickness and quality of the graphene sheets can be controlled by adjusting the microwave power and the solvent composition. The method is also relatively fast and can produce graphene in a matter of minutes.

In conclusion, continuous methods of making graphene from graphite offer numerous advantages, including scalability, control over the thickness and quality of graphene sheets, and low cost. Electrochemical exfoliation and microwave-assisted exfoliation are two such methods that have shown promise in producing high-quality graphene continuously.

Using a graphite electrode is immersed in an electrolyte solution, what are the electrical parameters to produce graphene and what is the liquid solution

The electrical parameters to produce graphene using a graphite electrode immersed in an electrolyte solution include the applied potential, current density, and reaction time. These parameters can be adjusted to control the thickness and quality of the graphene produced.

The applied potential refers to the voltage difference between the graphite electrode and the counter-electrode, and is typically in the range of 1-5 volts. A higher potential can lead to a higher exfoliation rate, but can also result in a lower quality graphene due to defects.

The current density is the amount of electrical current per unit area of the graphite electrode and is typically in the range of 0.01-1 mA/cm^2. A higher current density can lead to a higher exfoliation rate, but can also result in a lower quality graphene due to defects.

The reaction time is the duration of the electrochemical exfoliation process and is typically in the range of several minutes to hours. A longer reaction time can lead to a higher yield of graphene, but can also result in a lower quality graphene due to defects.

The liquid solution used as the electrolyte can vary depending on the specific electrochemical exfoliation method being used. Commonly used electrolyte solutions include sulfuric acid, hydrochloric acid, and sodium chloride solution. The choice of electrolyte solution can also affect the exfoliation rate and quality of the graphene produced.

What graphene research has been done at Rice university

Rice University is a leading institution in graphene research, and has made significant contributions to the field. Some of the notable graphene research conducted at Rice University includes:

Graphene oxide membranes: In 2017, a team of researchers from Rice University developed a graphene oxide membrane that could selectively filter molecules based on size and shape. This membrane has the potential to be used in a wide range of applications, including water purification and gas separation.
Graphene nanoribbons: In 2009, researchers at Rice University discovered a new method for creating graphene nanoribbons. This method involved using a chemical process to break down carbon nanotubes into nanoribbons, which are strips of graphene just a few atoms wide. Graphene nanoribbons have unique electronic properties that make them promising candidates for use in nanoelectronics.
Graphene supercapacitors: In 2011, researchers at Rice University developed a new type of supercapacitor made from graphene. These supercapacitors have the potential to store more energy than conventional batteries, and can be charged and discharged much more quickly.
Graphene-based composites: In 2013, researchers at Rice University developed a new type of composite material made from graphene and polymer. These materials are lightweight and strong, and have potential applications in aerospace and other industries.
Graphene-based biosensors: In 2018, a team of researchers at Rice University developed a new type of biosensor that uses graphene to detect biomolecules. These biosensors have the potential to be used in medical diagnostics and drug discovery.
These are just a few examples of the many significant contributions to graphene research that have been made at Rice University. The university continues to be a leader in the field, with ongoing research focused on developing new applications for graphene and advancing our understanding of its properties.

Mass Production of Exfoliated Graphene

Another method can produce over 30 g/h or more.

With current retail prices of $111 to $149 per gram (on the low end) that is about $5,328 to $7,152 gross sales income per hour. This is perfect for the small business.

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Small Garage Sized Graphene Micro Factory

Infinity is currently looking into developing a continuous flow production micro factory to produce good quality graphene, which can be used for boat building and other industries. With this micro factory cart, graphene additive for carbon fiber and other vacuum bagging fabrications would produce high material strengthening capacities.

We plan on offering a completed (and tested) cart for purchase or plans for licensing.

The primary inputs are electricity and graphite.

Please bookmark this page for further updates.

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