New Graphene-based, Nano-material Has Magnetic Properties

ScienceDaily (Sep. 2, 2009) — An international team of researchers has designed a new graphite-based, magnetic nano-material that acts as a semiconductor and could help material scientists create the next generation of electronic devices like microchips.

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Ferromagnetic graphene sheet. (Credit: Puru Jena/VCU)
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Published: Wednesday, September 2, 2009 - 11:17 in Physics & Chemistry

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Researchers work to design the next microchip

posted on: September 3, 2009 - 3:50pm

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Graphene, created by scientists five years ago, is 200 times stronger than steel, its electrons are highly mobile and it has unique optical and transport properties. Some experts believe that graphene may be more versatile than carbon nanotubes, and the ability to make graphene magnetic adds to its potential for novel applications in spintronics. Spintronics is a process using electron spin to synthesize new devices for memory and data processing.

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This is a ferromagnetic graphene sheet. Credit: Image courtesy of Paru Jena/VCU
Researchers Develop New Graphite-Based Magnetic Nanomaterial

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September 2nd, 2009

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A possible pathway to simply synthesize ferromagnetic graphene

Sathya Achia Abraham  
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9/1/2009  

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The team of researchers from Virginia Commonwealth University; Peking University in Beijing, China; the Chinese Academy of Science; and Virginia Commonwealth University led by Dr. Achia Abraham published their findings in the journal Nature. They created a new approach to developing graphene, a keystone material in the creation of electronic devices like microchips.

Graphene, an ultrathin layer of carbon atoms, has great potential for use in electronic devices because of its unique properties—its ability to conduct electricity and its strength. But producing large quantities of graphene is not easy. One technique is to use a solution of graphene to form a film, but this method is expensive and time consuming.

The Virginia Commonwealth University-Peking University team used a combination of chemical vapor deposition and enhanced etching to create a graphene film. The film is then chemically treated to make it magnetic. This process is not only cheaper and easier, but also allows for controlled magnetic properties, something previous techniques have not been able to achieve.
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By: Magali Gauthier
Date: 9/2/2009

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semi-hydrogenation provides us a very unique way to tailor magnetism. The resulting ferromagnetic graphene sheet will have unprecedented possibilities for the applications of graphene-based materials,” said Qiang Sun, Ph.D., research associate professor with the VCU team.

Contact: Sathya Achia Abraham
sabachia@vcu.edu
804-827-0880
Virginia Commonwealth University
Source: Eurekalert
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03.09.2009

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One of the important impacts of this research is that semi-hydrogenation provides us a very unique way to tailor magnetism. The resulting ferromagnetic graphene sheet will have unprecedented possibilities for the applications of graphene-based materials.

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9/3/2009 1:04:00 PM

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RESEARCH WATCH

Newly-developed 'graphene' makes spintronic devices closer than ever

By Dario Borghino
10:29 September 3, 2009 PDT

A team of researchers from the Virginia Commonwealth University, Peking University in Beijing, the Chinese Academy of Science, and Tohoku University in Japan has designed a new graphite-based magnetic nanomaterial that behaves as a semiconductor and could prove very important for ongoing research in the field of spintronics. Read More
Graphene made magnetic with hydrogen coating

R. Colin Johnson
EE Times
(09/03/2009 11:52 AM EST)

PORTLAND, Ore. — Graphene, a new magnetic version of carbon monolayers called graphene, could enable a new breed of carbon spintronic devices, researchers claim.

Graphene, consisting of pure crystalline carbon sheets, cannot be doped with impurities to adjust its semiconducting and magnetic properties as easily as silicon since carbon does not readily "heal" implantations with annealing. Rather than implanting dopants, researchers say, a surface treatment can be used to adjust a carbon sheet's properties.

Researchers say hydrogen can be used to fine-tune graphene's metallic, semiconductor and magnetic properties, resulting in either graphene (metallic), graphane (semiconducting) or graphone (ferromagnetic).
"MATERIALS: Graphene made magnetic with hydrogen coating"

Carbon sheets--graphene--can be made ferromagnetic, called graphene, by adjusting the amount of hydrogenation on their surface, according to these researchers. With an adjustable magnetic moment that can couple ferromagnetically, graphene allows the magnetism to be harnessed in semiconducting devices. Look for spintronic devices using graphene within 10 years. R.C. J.

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New graphene-based nanomaterial with magnetic properties designed

(Thursday, 03 September 2009 00:21)

An international team of researchers has designed Graphene, a new magnetic nanomaterial made by adding hydrogen atoms to graphene (a form of carbon), with the potential for novel applications in spintronics devices for memory and data processing.

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Enlarge This is a ferromagnetic graphene sheet. Credit: Image courtesy of Puru Jena/VCU. An international team of researchers has designed a new graphite-based, magnetic nano-material that acts as a semiconductor and could help material scientists create the next generation of electronic devices like microchips. The team of researchers from Virginia Commonwealth University; Peking University in Beijing, China; the Chinese Academy of Science in Shanghai, China; and Tohoku University in Sendai, Japan; used theoretical computer modeling to design the new material they called graphyne, which is derived from an existing material known as graphene. Graphene, created by scientists five years ago, is 200 times stronger than steel, its electrons are highly mobile and it has unique optical and transport properties. Some experts believe... [read full story]
Graphene-based nanomaterial with magnetic properties
(Virginia Commonwealth University)

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Newly-developed ‘graphone’ makes spintronic devices closer than ever

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Spintronics, or magnetoelectronics, is an emerging technology that harnesses the spin of electrons along with their electrical charge to store and transfer information in digital form. Because the electronic spin is closely related to magnetism, techniques that attempt to manipulate these particles must present strong and highly controllable magnetic properties.
New graphite-based nano-material may herald next generation of electronic devices

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Researchers design new graphene-based, nano-material with magnetic properties

- 2 Sep 2009

By Virginia Commonwealth University

A possible pathway to simply synthesize ferromagnetic graphene

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Graphene made magnetic with hydrogen coating

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Researchers design new graphene-based, nano-material with magnetic properties

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Thu, Sep 3 01:05 PM

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Graphene: New Magnetic Graphene-Based Nanomaterial

September 5th, 2009 at 9:25 am » Comments (0)

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PhysOrg.com, Sept. 3, 2009

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Nuevo material magnético basado en el grafeno/A new graphene based magnetic material

Un equipo internacional de investigadores (pertenecientes a la Virginia Commonwealth University (VCU), Universidad de Pekín, Academia China de Ciencias de Shanghai y la Universidad Teikoku de Sedai en Japón) ha diseñado un nuevo nano-material magnético basado en el grafito que actúa como semiconductor y que podría ayudar a fabricar componentes electrónicos, como micro-chips, de próxima generación.

El nuevo material se llama grafeno ( grafeno) y deriva del...
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September 3rd, 2009 - 2:08 pm ICT by ANI

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Hot topics

Carbon chipped

Posted on September 10th, 2009 by David Bradley

An international team of researchers has developed a new magnetic carbon material that not only acts as a semiconductor but is also magnetic and could help scientists develop the next generation of microelectronic devices.

The new carbon material is based on graphene, which resembles graphite, the form of carbon found in pencil "lead," but which exists as single sheet-like layers resembling nanoscopic chicken wire fencing. Graphene was first created by scientists in Manchester five years ago and is not only 200 times stronger than steel but because its electrons are highly mobile it has unique electro-optical properties. As such, some researchers think that graphene is the natural successor to silicon and could lead to the advent of spintronic devices that exploit electron spin and charge in computer memory and data processing.
New graphite based magnetic nano material developed

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Huntsman levels sites on Tronox, PPG to get new CFO, Sulzer posts financials
SpecialChem | Mark Drukenbrod - Sep 8, 2009

Hello and welcome to your early week international coatings industry update, brought to you by SpecialChem. News has surged again, and we have a lot to talk about, starting with lessons learned in mergers and acquisitions.

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Edited By Ann_Science • September 3, 2009

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Researchers design new graphene-based, nano-material with magnetic properties (9/4/2009)

A possible pathway to simply synthesize ferromagnetic graphene...> Full Article
Ferromagnetism in Semihydrogenated Graphene Sheet.

Zhou J, Wang Q, Sun Q, Chen XS, Kawazoe Y, Jena P.

Department of Advanced Materials and Nanotechnology, and Center for Applied Physics and Technology, Peking University, Beijing 100871, China, Department of Physics, Virginia Commonwealth University, Richmond, Virginia 23284, Shanghai Institute of Technical Physics, Chinese Academy of Science, Shanghai 200083, China, and Institute for Material Research, Tohoku University, Sendai, 980-8577, Japan.

Single layer of graphite (graphene) was predicted and later experimentally confirmed to undergo metal-semiconductor transition when fully hydrogenated (graphane). Using density functional theory we show that when half of the hydrogen in this graphene sheet is removed, the resulting semihydrogenated graphene (which we refer to as graphane) becomes a ferromagnetic semiconductor with a small indirect gap. Half-hydrogenation breaks the delocalized pi bonding network of graphene, leaving the electrons in the unhydrogenated carbon atoms localized and unpaired. The magnetic moments at these sites couple ferromagnetically with an estimated Curie temperature between 278 and 417 K, giving rise to an infinite magnetic sheet with structural integrity and magnetic homogeneity. This is very different from the widely studied finite graphene nanostructures such as one-dimensional nanoribbons and two-dimensional nanoholes, where zigzag edges are necessary for magnetism. From graphene to graphane and to graphane, the system evolves from metallic to semiconducting and from nonmagnetic to magnetic. Hydrogenation provides a novel way to tune the properties with unprecedented potentials for applications.

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Graphene: New Magnetic Graphene-Based Nanomaterial

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