

Researchers show applied electric field can significantly improve hydrogen storage properties

Published: Tuesday, February 2, 2010 - 15:16 in [Physics & Chemistry](#)

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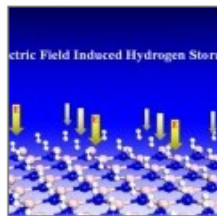


Image courtesy of Qian Wang, Ph.D./VCU.

However, it has been difficult to find materials that can efficiently and safely store and release it with fast kinetics under ambient temperature and pressure.

The team of researchers from Virginia Commonwealth University; Peking University in Beijing; and the Chinese Academy of Science in Shanghai; have developed a process using an electric field that can significantly improve how hydrogen fuel is stored and released.

An international team of researchers has identified a new theoretical approach that may one day make the synthesis of hydrogen fuel storage materials less complicated and improve the thermodynamics and reversibility of the system. Many researchers have their sights set on hydrogen as an alternative energy source to fossil fuels such as oil, natural gas and coal that contain carbon, pollute the environment and contribute to global warming. Known to be the most abundant element in the universe, hydrogen is considered an ideal energy carrier – not to mention that it's clean, environmentally friendly and non-toxic.

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Applied Electric Field Can Significantly Improve Hydrogen Storage Properties

ScienceDaily (Feb. 3, 2010) — An international team of researchers has identified a new theoretical approach that may one day make the synthesis of hydrogen fuel storage materials less complicated and improve the thermodynamics and reversibility of the system.

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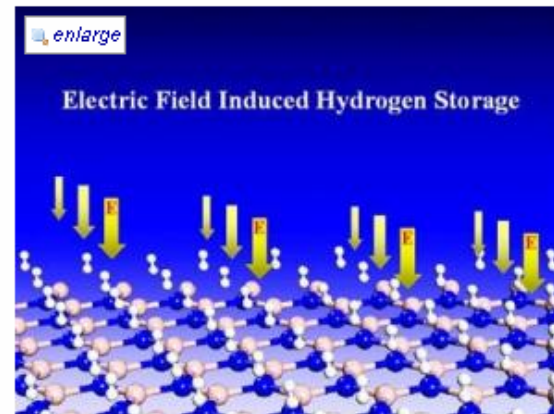
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This image illustrates that an applied electric field polarizes hydrogen molecules and the substrate, inducing hydrogen absorption with good thermodynamics and kinetics. (Credit: Image courtesy of [Qian Wang, Ph.D./VCU](#))

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Electric Field Could Improve Hydrogen Storage Systems

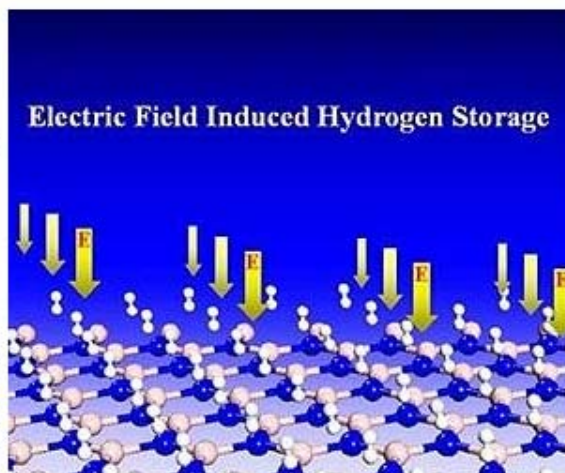
by Sathya Achia Abraham
Richmond VA (SPX) Feb 04, 2010

An international team of researchers has identified a new theoretical approach that may one day make the synthesis of hydrogen fuel storage materials less complicated and improve the [thermodynamics](#) and reversibility of the system.

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This image illustrates that an applied electric field polarizes hydrogen molecules and the substrate, inducing hydrogen absorption with good thermodynamics and kinetics. Image courtesy of [Qian Wang, Ph.D./VCU](#).

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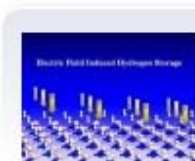

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Hydrogen Storage Systems to Get Innovation

Applying electric fields can benefit the process

By **Tudor Vieru**, Science Editor
February 3rd, 2010, 11:52 GMT

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One of the main reasons why hydrogen-powered vehicles are not the norm in our world today is the fact that batteries and fuel cells are not yet efficient enough at delivering their charge. In addition, reloading them can be a very complicated and time-consuming process, and this is why [physicists](#) have been working on ways of improving the thermodynamics and reversibility of hydrogen-storing materials. There is also an ongoing effort to make them less complex, and therefore cheaper, and a team of scientists from the US and China may already be on to something, [ScienceDaily](#) informs.

The team developed a theoretical model that could lead to the creation of simpler, more efficient hydrogen-storage materials in the near future. The scientists argue that using an electric field on these materials could significantly improve the rate at which they store and release the chemicals. The main trouble with hydrogen fuels is getting the substances holding them to release it with fast kinetics under ambient temperature and pressure. At this point, these materials require a number of special conditions that cannot be satisfied within a personal vehicle, and need the controlled confines of a lab to work.

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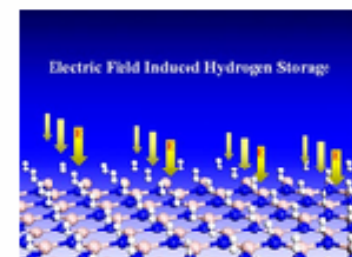
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US and China Researchers Show New Approach to Hydrogen Storage; Applied Electric Field Can Significantly Improve H₂ Storage and Reversibility Properties of Polarizable Substrates

3 February 2010

Using density functional theory, a team of researchers from Virginia Commonwealth University; Peking University in Beijing; and the Chinese Academy of Science in Shanghai has [shown](#) that an applied electric field can substantially improve the hydrogen storage properties of polarizable substrates. The new approach could make the synthesis of hydrogen fuel storage materials less complicated and improve the thermodynamics and reversibility of the system.

They demonstrated their new concept by adsorbing a layer of hydrogen molecules on a number of nanomaterials. When one layer of H₂ molecules is adsorbed on a BN sheet, the binding energy per H₂ molecule increases from 0.03 eV/H₂ in the field-free case to 0.14 eV/H₂ in the presence of an electric field of 0.045 au (atomic units). The corresponding gravimetric density of 7.5 wt% is consistent with the 6 wt% system target set by Department of Energy for 2010.



An applied electric field polarizes hydrogen molecules and the substrate, inducing hydrogen absorption with good thermodynamics and kinetics. Image courtesy of Qian Wang, Ph.D./VCU. [Click to enlarge.](#)

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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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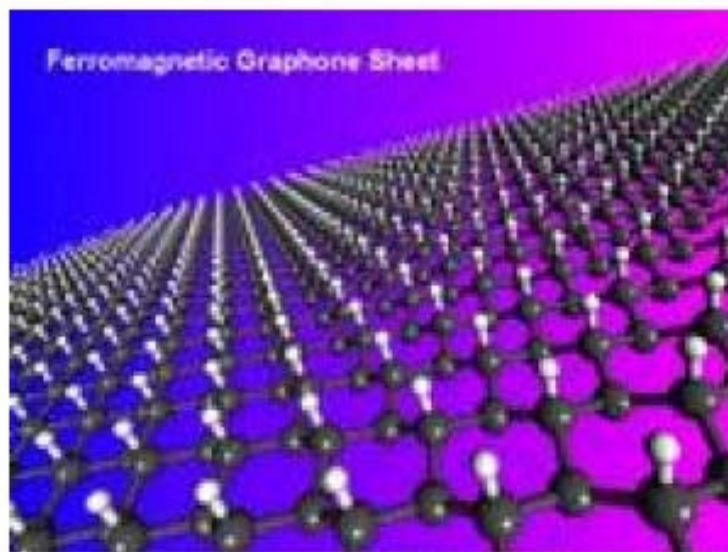
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The team of researchers from Virginia Commonwealth University; Peking University in Beijing, China; the Chinese Academy of Science in Shanghai, China; and Tohoku University in Sendai, Japan; used theoretical computer modeling to design the new material they called graphone, which is derived from an existing material known as graphene.



Ferromagnetic graphone sheet. (Credit: Puru Jena/VCU)

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

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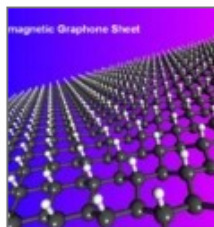










Image courtesy of Puru Jena/VCU

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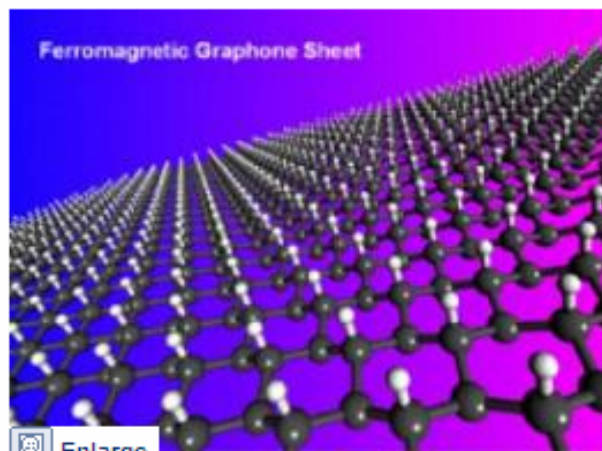
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New graphene-based nanomaterial with magnetic properties designed

September 2nd, 2009



This is a ferromagnetic graphone 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.



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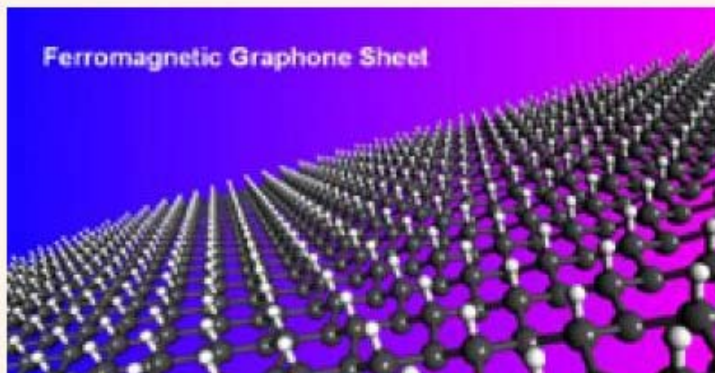


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Graphene, created by scientists five years ago, is 200 times stronger than steel, its electrons are highly mobile and it has unique optical and transport properties. Some experts believe that graphene may be more versatile than carbon nanotubes, and 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.

Although graphene's properties can be significantly modified by introducing defects and by saturating with hydrogen, it has been very difficult for scientists to manipulate the structure to make it magnetic.

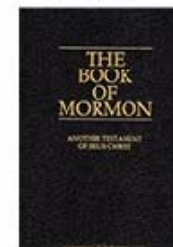


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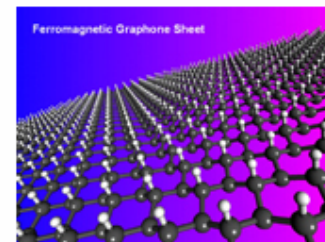
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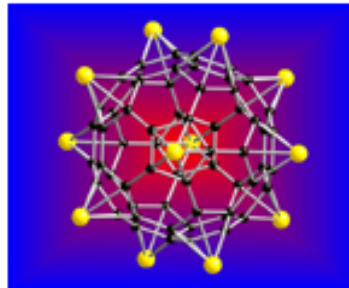
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Peter Weiss

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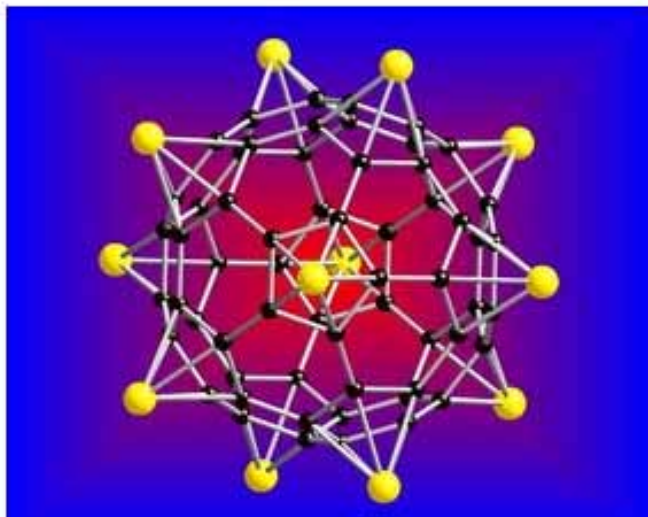
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July 24, 2006

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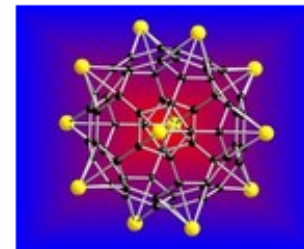
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Researchers Design Lithium-Coated Buckyball with 13 wt.% Hydrogen Storage

July 24, 2006

Researchers at Virginia Commonwealth University have [described](#) a potential new hydrogen storage system for vehicular applications based on lithium-coated buckyballs. The new material promises a gravimetric storage density of 13 wt.% &mdash



A lithium-coated fullerene (buckyball) as a potential material for hydrogen storage. Yellow represents lithium atoms, and black represents carbon atoms. Click to enlarge.

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Lithium 'Buckyballs' As Hydrogen Storage Medium

Source: [Virginia Commonwealth University](#)
[Jul 27, 2006]

SYNOPSIS: Industry standards require materials that store hydrogen to have a high gravimetric density of 9 weight percent, and high volumetric density of 70 grams/liter. The material developed at Virginia Commonwealth University can store 13 percent.

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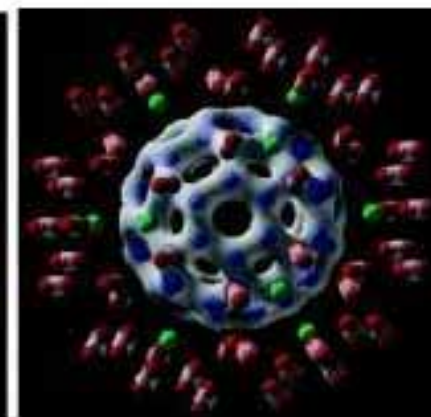
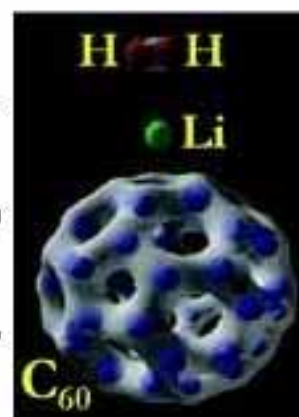
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Da redação
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Provavelmente ainda não é o "tanque definitivo" de hidrogênio. Mas os cientistas conseguiram determinar a composição teórica de um material que consegue aprisionar uma grande quantidade de átomos de hidrogênio para cada átomo de material ativo.

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Virginia Commonwealth University researchers have developed a new storage system to hold large quantities of hydrogen fuel that may one day power cars in a more cost-effective and consumer-friendly way.

This theoretical research moves scientists another step closer in the exploration of alternative fuel sources and methods to store hydrogen fuel.



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By Virginia Commonwealth University
Jul 31, 2006, 07:00

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DEVELOPING ALTERNATIVES TO FOSSIL FUELS
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Researchers: Hydrogen Storage System Could Power Cars Cost-Effectively

Virginia Commonwealth University (VCU) researchers announced on July 24 they have developed a new storage system to hold large quantities of hydrogen fuel that could one day power cars in a more cost-effective and consumer-friendly way.

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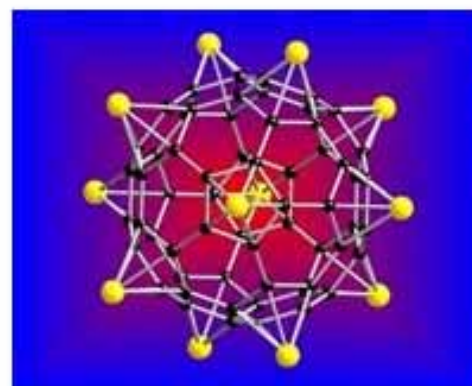
Developing Alternatives to Fossil Fuels

by Staff Writers

Richmond VA (SPX) Aug 03, 2006

Virginia Commonwealth University researchers have developed a new storage system to hold large quantities of hydrogen fuel that may one day power cars in a more cost-effective and consumer-friendly way. Newswise ?Virginia Commonwealth University researchers have developed a new storage system to hold large quantities of hydrogen fuel that may one day power cars in a more cost-effective and consumer-friendly way.

This theoretical research moves scientists another step closer in the exploration of alternative fuel sources and methods to store hydrogen fuel.



A lithium-coated fullerene, also known as a C60 cluster, as a potential material for hydrogen storage. Yellow represents lithium atoms, and black represents carbon atoms.

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Developing Alternatives To Fossil Fuels

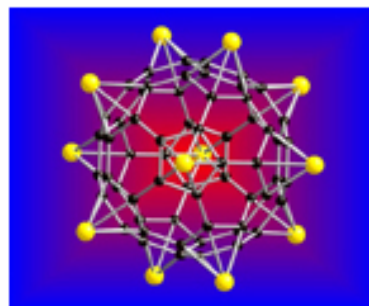
(Newswise) Virginia Commonwealth University researchers have developed a new storage system to hold large quantities of hydrogen fuel that may one day power cars in a more cost-effective and consumer-friendly way...7/24

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Lithium buckyballs to store hydrogen?

2006-8-7

Hydrogen fuel, which is an ideal energy carrier and environmentally friendly because it releases only water in the air, might one day power our cars and reduce our dependency on fossil fuels. But first we need to find ways to produce it — and to store it. And now, researchers at Virginia Commonwealth University (VCU) have developed a new storage system for hydrogen based on lithium-coated buckyballs. The clusters they've designed — by using computer modeling — are composed of 12 lithium atoms and 60 carbon atoms, are very stable and can store up to 120 hydrogen atoms in molecular form. The researchers now have to prove that hydrogen can be stored in the lithium-coated fullerenes.

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Lithium buckyballs to store hydrogen?

Story Tags: [hydrogen](#), [lithium](#), [Storage](#)

Excerpt: In an effort to reduce our dependency on fossil fuels, researchers at Virginia Commonwealth University have developed a new storage system for hydrogen based on lithium-coated buckyballs. So will we see one day lithium-based tanks in future hydrogen refueling stations? It's too early to be sure. Read more... - [Read More](#)

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Virginia Commonwealth University physicists, working with one of the most precious materials on Earth – [gold](#) -- and with one of the most common - sand -- have created a so-called "nano-bullet" that targets tumors and may help scientists develop non-invasive cancer treatments.

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October 20th, 2004

Nano-bullet for non-invasive treatment of cancers

Abstract:

Virginia Commonwealth University physicists have created a so-called "nano-bullet" that targets tumors and may help scientists develop non-invasive cancer treatments.

Story:

[VCU scientists studying nano-bullet for non-invasive treatment of cancers](#)

Richmond, VA, October 20, 2004

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The scientists found that when gold particles are reduced to a few nano-meters -- just billionths of a meter -- they become highly reactive and readily bind to silica clusters, allowing the cluster to absorb infrared light and create enough heat to potentially kill cancer tumors. Silica is the main element in sand.

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Nano-bullet for non-invasive treatment of cancers

Posted By: [News-Medical](#) in [Medical Science News](#)

Published: Wednesday, 20-Oct-2004



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Nano-bullet for non-invasive treatment of cancers

Date: Wednesday, October 20, 2004 @ 22:54:57 PDT

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Nano-bullet for non-invasive treatment of cancers

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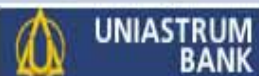
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Nano-Bullet For Non-Invasive Treatment of Cancers

By: Svidinenko (Svidinenko) 2004.10.21

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Richmond, VA, October 20, 2004

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Nano-Bullet For Non-Invasive Treatment of Cancers

10/21/2004

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