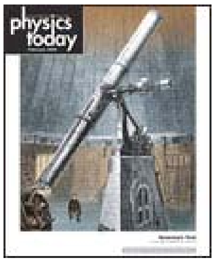

Current issue

The Perfect Nanoballoon

Article in Applied Physics Letters Described How Ultrathin "Graphene" Carbon Sheets Keep Everything Inside

COLLEGE PARK, MARYLAND, 20 November 2008 — Airtight containers are not always so airtight. As any child will discover the day after a birthday party, even a tightly tied helium balloon will leak its gas out over the course of many hours. Now scientists have come up with a supremely efficient barrier that lets nothing in or out.

As described in a recent issue of the journal Applied Physics Letters, this new wrapping material is made of graphene, a natural carbon fabric that is only a single-atomic-layer thick.

A related form of carbon, graphite, is used in pencils. At the microscopic level, graphite consists of billions of two-dimensional sheets of carbon atoms. The fact that these sheets are only loosely attached to each other is what makes graphite such a good lubricant. Graphene is what you get when you take the layers of graphite one at a time. Such little slivers of carbon -- imagine chicken wire made of carbon atoms -- can hardly be seen, and therefore graphene was only discovered a few years ago.

Now, because of graphene’s interesting properties -- such as the fact that electrons flow through it without much energy loss -- it has become a hot topic among physicists. One of the most impressive properties is its mechanical strength, which is surprising since it is so thin.

Both experiments in the lab and simulations carried out in a computer have now shown that graphene sheets can sustain high pressure and act as ideal containers. Physicists in the theory group of Francois Peeters at the University of Antwerp in Belgium have performed studies of how graphene sheets can hold gases within a tiny balloon structure. If any atom could escape from a nanoscopic bag it would be helium. As one of the noble gases, helium is chemically inert and might be able to wiggle past any atomically-thin enclosure. But, according to Antwerp researcher Ortwin Leenaerts, helium is unable to escape.

An experiment at Cornell in the laboratory of Harold Craighead, with a sheet of graphene stretched across a tiny bottle holding gas, has shown that indeed the gas, even high-pressure gas, is kept in. (This work was published in the journal Nano Letters).

Leenearts says that graphene, aside from its electrical properties, can contribute to a number of nanotech products. Examples include tiny pressure sensors: depending on the pressure of a gas in a tiny bottle, the graphene “stopper” of such a bottle would vibrate at telltale frequencies. A tiny patch of graphene could serve as a nanoresonator: clamped on two sides, the graphene would vibrate at radio frequencies. An electrical signal could be sent in, causing the graphene to act as a tiny radio antenna. Graphene might even be used as an artificial membrane. Formed into a nanoscopic vesicle, almost like an artificial cell, the graphene could contain medicine that might be released in the body in a time-release manner.

The article "Graphene: A perfect nanoballoon" by O. Leenaerts, B. Partoens, and F. M. Peeters was published November 12, 2008 in Appl. Phys. Lett. (Volume 93, Issue 19). The article is available at **http://link.aip.org/link/?APPLAB/93/193107/1** (http://link.aip.org/link/?APPLAB/93/193107/1) . Journalists can obtain the text at **www.aip.org/physnews/select** (http://www.aip.org/physnews/select) .

About the Journal

Published by the American Institute of Physics (AIP), Applied Physics Letters is a weekly journal featuring concise, up-to-date reports on significant new findings in applied physics. Emphasizing rapid dissemination of key data and new physical insights, Applied Physics Letters offers prompt publication of new experimental and theoretical papers bearing on applications of physics phenomena to all branches of science, engineering, and modern technology. See: **http://apl.aip.org/ (http://apl.aip.org/)** .

About AIP

The American Institute of Physics (AIP) is a non-profit corporation chartered in 1931 for the purpose of advancement and diffusion of the knowledge of physics and its application to human welfare. An umbrella organization for 10 Member Societies, AIP represents over 134,000 scientists, engineers and educators and is one of the world's largest publishers of physics journals. A total-solution provider in publishing services, AIP publishes its own 12 journals (many of which have the highest impact factors in their category), two magazines, and the AIP Conference Proceedings series. Its online publishing platform Scitation hosts more than 1,000,000 articles from more than 175 scholarly journals, as well as conference proceedings, and other publications of 25 learned society publishers. See: **http://www.aip.org (http://www.aip.org)** .

For more information:

Phillip Schewe, AIP
(301) 209-3092,
pschewe@aip.org (mailto:pschewe@aip.org)

Jason Socrates Bardi, AIP
(301) 209-3091,
jbardi@aip.org (mailto:jbardi@aip.org)