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Silver News

Silver Aerogels Keep Nuclear Stockpile Secure

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Silver, gold, and copper aerogels are so light that they can ride on a mosquito's back.

When can silver be almost as light as air? When it's in the form of an aerogel, a web of randomly connected nanometer-sized wires formed into the shape of a tiny marshmallow and containing the same or a smaller number of atoms as air, according to project officials at the U.S. Lawrence Livermore National Laboratory.

Aerogels are sometimes known as 'frozen smoke' or 'solid air' because of their low weight and the manner in which light scatters in the materials. They are often used as insulating material, or, in this case, they were created to help physicists get a better X-ray source to use in maintaining and experimenting with the United States' nuclear stockpile. In the 1990s, the U.S. nuclear weapons program moved from developing new nuclear weapons designs to dismantling thousands of existing weapons and maintaining a much smaller stockpile. The Department of Energy created the science-based Stockpile Stewardship Program to maintain the safety, security, and reliability of the U.S. nuclear deterrent without full-scale testing.

The silver aerogel (the lab also produced aerogels from copper and are still working with gold) is heated by lasers, producing a plasma which is then used as a source of unique X-rays used in stockpile experiments. However, laser-driven X-ray sources can be tough to keep consistent because of the differences in the aerogels (types, densities, shapes, etc.), which has been the major challenge for the researchers. "We need heavy metal targets to be around the density of air and a few millimeters in size within well-defined dimensions," said Tyler Fears, a staff scientist with the Lab's Materials Science Division, in a prepared statement. "Our challenge is to try to meet all those goals at the same time. You need to be able to make either the same material or a comparable material every time," he added. "We have to understand when we change something, how is that going to change the product? If you change the density or if you change the shape, you have to know that's the only thing you're changing."

Aerogel research has been going on for about 10 years, but the ability to make metal aerogels for use in X-rays is relatively recent. The 'trick' was to produce the structure from nanowires of the metals. The team freezes the nanowires inside a mold filled with a water-glycerol mix. When it hardens,

continued on page 2

continued from page 1

the nanowire looks like a "randomly interconnected mesh of frozen spaghetti," one of the team members noted. The material is removed from the mold and the ice is extracted by replacing it with the solvent acetone, which is then dissolved in a drying process using liquid carbon dioxide. This leaves only the metal and air.

"Translating these successes into other materials (e.g., gold) raised significant technical challenges that we are navigating," said another team member. "I attribute our success to an innovative, diverse team of scientists that share their varied technical backgrounds to solve a highly multi-disciplinary challenge."

"Physicists come up with ideas, but usually they will ask what someone can make, and they will design an experiment around that," Fears added. "If we can make a material that they never thought we could make before, they'll come up with new experiments to fit those capabilities."

'Smart Pill Bottle' Utilizing Silver Can Prevent Tampering and Drug Abuse

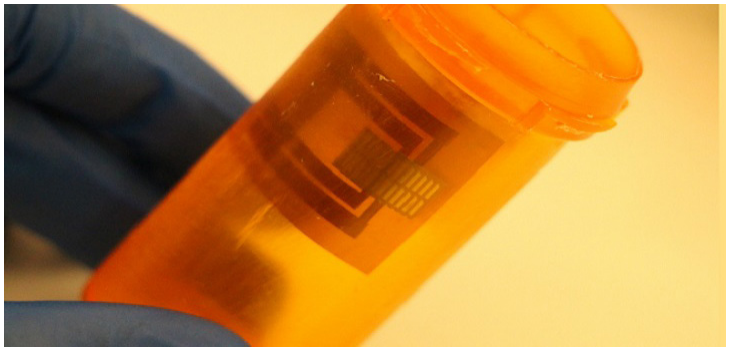
A smart pill bottle that sends wireless alerts when it detects tampering, improper use or unsafe storage conditions of the medicine inside (temperature and humidity, for example,) is made possible by an adhesive that consists of silver particles sandwiched between two layers of copper tape.

When pressed by a finger, the tape makes an electrical connection that sends a signal to an external reader, usually via Bluetooth to a mobile phone. The pill bottle can be produced in great numbers and at low cost, according to developers at King Abdullah University of Science and Technology (KAUST) in Thuwal, Saudi Arabia.

"Similar devices have been used in flat panel displays," said doctoral student Sherjeel Khan, in a prepared statement, "but we've made them simple to build and easy to use by almost anyone."

Light emitting diodes (LEDs) are 3-D printed into the lid and they count the number of pills. At the same time, paper-based humidity and temperature sensors are also taped inside. The bottle is then sealed with the copper/silver particle tape that sets off an alert when the lid is opened. An alert is also sent if the contents become too moist or too hot, conditions that would render the medicine ineffective or unsafe.

Founded in 2009, KAUST is a private research university that provides research and graduate training programs in English, its official language of instruction. The university is the first mixed-gender university campus in Saudi Arabia.



MUHAMMAD M. HUSSAIN

This smart pill bottle can send an alert when the bottle is opened.

2020 Olympic Medals Will be Made from Recycled E-Waste

Japan has met its goal of collecting enough silver, gold and bronze (copper and tin) from e-waste, mainly from mobile phones and other small devices, to produce all of the medals for the upcoming 2020 Summer Olympic and Paralympic games.

The Olympic planning committee collected the e-waste by placing collection boxes in over 2,400 NTT Docomo phone stores as well as other places in Japan. The effort began in 2017.

All totaled, the collection effort reached its goal: 9,000 pounds of silver, 67 pounds of gold and 6,000 pounds of bronze. Over 5 million devices yielded $3 million worth of metals. At the 2016 Olympic games in Rio de Janeiro games, over 900 medals were awarded. According to the International Olympic Committee rules, gold and silver medals contain 92.5% silver and the gold medals must be plated with at least 6 grams of gold. The bronze medals are composed of copper and tin. All medals must be at least 3 mm thick and at least 60 mm in diameter.

The typical mobile phone contains 90 mg of silver, 36 mg of gold, 0.7 grams of tin and 6 grams of copper. These amounts were recently verified by scientists at the University of Plymouth in southwest England, who placed mobile phones in laboratory blenders to extract the metal components. (See *How Much Silver is in a Smartphone? The Amount May Surprise You,* April, 2019 *Silver News*)

The Japan Olympic Committee will reveal the medals' designs this summer.

All medals for the 2020 Olympics in Japan will be made from e-waste.

Inexpensive Silver 'Swimmers' Can Seek Out and Destroy Pollutants

Swiss and Italian scientists have used 3-D printing to create a microrobot capable of identifying pollutants in water and killing bacteria. The devices were produced with a layer composed of silver coated by a layer of silver/titania composite. (Titania is another name for titanium dioxide.)

With sizes ranging from micrometers to millimeters, the researchers noted that the small machines can be produced cheaply and in batches. They can be deployed into bodies of water – a lake, for example – without having to be retrieved because the cost is low compared to comparable cleaners known as 'swimmers.'

"The biocidal activity of silver and the photocatalytic properties of titania can be combined in a composite material to achieve integrated water cleaning functionalities," the researchers stated in an article published in the *Journal of Materials Research and Technology*. They added: "The microrobots obtained in the present work may find application in water purification inside small water reservoirs and canalizations, possibly with a scaled up magnetic actuation setup. Moreover, the devices can be used for bacteria control also in the presence of mammal cells, suggesting a possible use inside the human body. In conclusion, they are attractive for applications requiring a combination of antimicrobial and photocatalytic functionalities that must be carried out, also separately, in a highly localized and precise way."

Silver Beats Copper as Catalyst to Transform Greenhouse Gas

As the effects of climate change are growing more pronounced, scientists continue to search for new ways to change greenhouse gas carbon dioxide, caused by the burning of fossil fuels, into carbon monoxide so it can be used to make syngas (synthetic gas) a feedstock for producing useful chemicals. Syngas is a fuel/gas mixture consisting mostly of hydrogen and carbon monoxide.

Because carbon dioxide is chemically reactive, catalysts such as copper and silver are used to help facilitate the change from carbon dioxide to carbon monoxide. In order to fully understand how this reaction takes place researchers at the University of California at Berkeley and the California Institute of Technology (Caltech) have studied how carbon dioxide reacts when placed on the surfaces of both metals. Their experiments have shown that silver works more efficiently as a catalyst than copper. In other words, more carbon monoxide is produced. The team noted in their report: "… silver represents a significantly more favorable activation mechanism than CO_2 on copper."

"Before, people always thought that the process was the same on all metals," said Berkeley Lab researcher Yifan Ye, one of the study's authors. "But now, we have discovered that there are other options for reactions. This is new chemistry, and it's a new reaction pathway."

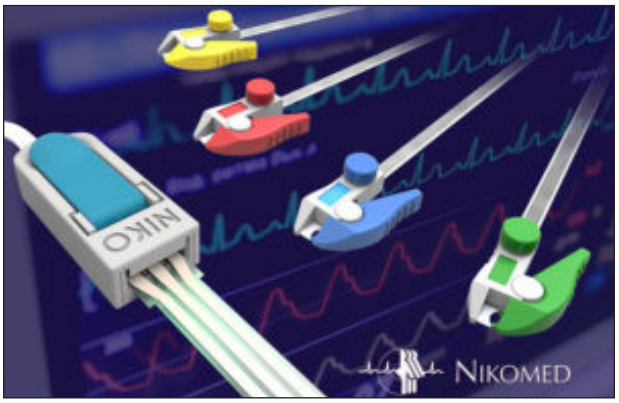
The work involved a close collaboration between theorists from Caltech and experimentalists from Berkeley Lab's Advanced Light Source, working together under the umbrella of the Joint Center for Artificial Photosynthesis, a Department of Energy Innovation Hub.

First Recyclable Medical Monitor Wire Made from Silver Ink-Coated Plastic

The first recyclable medical lead wire – like those used for heart monitors – has been introduced by Nikomed USA Inc., company officials say. The wire, called *BioWire*, is constructed of plastic coated with silver ink. The plastic is polyethylene terephthalate (PET), a type of polyester commonly used to produce beverage bottles.

The wire's main advantage, company officials note, is that it is recyclable as opposed to conventional lead wires that must be discarded. Another advantage is that the wire's ribbon-like design allows healthcare workers to apply a label, such as the patient's name, to the lead. The product is in the final stages of development and the Hatboro, Pennsylvania, company expects to fill orders during the last quarter of this year.

The company also markets one-layer electrodes named *Nikotabs* in various sizes to fit different patients. The electrodes are designed with a silver/silver chloride substrate.



NIKOMED

BioWire monitor leads are recyclable and made of polyethylene terephthalate (PET) and silver ink.

Silver Institute's Membership Elects New Officers

Michael Steinmann, President and CEO of Pan American Silver Corp., has been elected President of the Silver Institute by its membership. He succeeds Octavio Alvidrez, CEO of Fresnillo plc. Bradford Cooke, CEO of Endeavour Silver Corp., was elected Vice President of the Silver Institute, succeeding Steinmann. Both companies are based in Vancouver, Canada, and Steinmann and Cooke will each serve a two-year term.

Michael Steinmann has over 25 years of experience in the base and precious metals industry and has been with Pan American Silver Corp. in different roles since 2004. He was promoted to President in 2015 and named President and CEO in 2016. He holds a Ph.D. in Natural Science (Geology) from the Swiss Federal Institute of Technology (ETHZ), a M.Sc. in Geology from the University of Zurich, and a Degree in Corporate Finance from Escuela Superior de Administración y Negocios, Lima.

Bradford Cooke is a professional geologist and entrepreneur with 43 years of experience in the mining industry. He has specialized in the formation, management and financing of exploration and mining companies and the acquisition, exploration, development and mining of mineral properties. In 2003, he founded Endeavour Silver Corp. for the purpose of acquiring high-grade silver-gold projects in Mexico. Cooke received a B.Sc. Geology degree (Honors) from Queens University in 1976 and a M.Sc. Geology degree from the University of British Columbia in 1984.

Victorian American Silver Hollowware Online Museum Launched

"An online museum exhibition is a museum for the many, not for the few," says Thomas Scanlon, founder and curator of the American Silver Museum, (ASM) an online photographic look at Victorian American silver-plated, mass market hollowware. "The ASM bows to consumer demands for 'in-home' experiences. Consumers no longer need to leave their desk to have a shopping experience, a food experience, a theater experience, or travel experience. The ASM is kind of the Grubhub, Uber, or Amazon Prime of museum experiences."

Scanlon went live with the ASM in May with items from his own collection, which he photographs or videos in his home.

Scanlon says that the online format fits the collection better than if they were in a brick-and-mortar building. "While it is a museum that figuratively and literally focuses on Victorian American silver-plated hollowware, its artistic and cultural value cannot be appreciated without the use of digital photographic techniques and the display of those photographs in electronic media. It is not the photograph of the teapot, sugar bowl, or candle holder that interests our visitors, it is the use of the silver plate as a canvas for artistic expression that we capture with the camera lens that makes our exhibits unique and valuable."

His goal is not to monetize the collection but to find a museum that could house the collection. "Most importantly, I would like ASM to be a template for museums to use in the exhibition of this incredible expression of silversmithing that they most probably own but can only warehouse."

Click the image to watch a video of a Meriden Ice Pitcher.

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