

# Silver News

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## Silver Metallic Glass Tougher Than Steel

By Samuel Etris, Senior Technical Consultant to the Silver Institute



CALIFORNIA INSTITUTE OF TECHNOLOGY

By producing 'metallic glass' scientists at the California Institute of Technology have combined the strength of glass with the toughness of metal.

Trying to produce a material that is both strong and tough may sound easy, because the words seem interchangeable, but it's not. Glass is strong because it resists scratches and is difficult to bend. But, glass is brittle. Metals are tough, but bend and deform under heavy loads.

There may be a compromise. Marios Demetriou, a materials scientist at the California Institute of Technology in Pasadena, is working on a material that will combine the strength of glass with the toughness of metal. He is doing this by adding silver to a palladium, phosphorous, silicon, germanium melt which results in a metallic glass that is both strong and tough.

Characterizing the material as 'amorphous metals,' Demetriou and his colleagues cool molten metals extremely rapidly to prevent the atoms from organizing into their usual metallic structure upon cooling. The resulting metal/glass could have applications for medical implants. "With such high damage tolerance capacity, implants made out of the new material will probably far outperform implants made of current materials," says Demetriou. This could reduce recuperation time and last longer in the body. Furthermore, all of the metals are biocompatible and the presence of silver provides a bactericidal component. Unlike brittle oxide glasses, metallic glasses yield plastically under stress, thus making them ideal where damage tolerance is essential to their performance.

"It has probably the best combination of strength and toughness that has ever been achieved," said Robert O. Ritchie, a materials scientist at Lawrence Berkeley National Laboratory, one of Demetriou's team. "It's not the strongest material ever made, but it's certainly one of the best with a combination of strength and toughness." Its chemical structure overcomes the inherent brittleness of glass, but maintains its strength. It's not very dense, more lightweight than steel with a weight comparable to an aluminum or titanium alloy.

Some tougher materials exist, but they are less strong, and there are stronger materials, but they're not as tough. "The holy grail is to get both those properties at the same time," Ritchie said.

# Platinaire Making Inroads

As gold continues to hit new highs, jewelry makers are seeking alternatives including a mixture of silver and platinum known as *platinaire*.

For example, [Conni Mainne Designs](#) uses platinaire -- patented and trademarked by [A.G. Weindling](#) -- in its new *Moonlight Dreams* collection. The jewelry is composed of sterling silver with 5 percent platinum. The alloy resists tarnishing better than sterling-only pieces and has a chrome-colored tint. U.S. retailer J.C. Penney is also featuring platinaire jewelry to help keep prices flat, according to company officials.

Alexander Weindling, Chief Executive Officer of A.G. Weindling, says that platinaire is hypoallergenic, crafted predominantly from recycled materials, harder than sterling and as easily sized as gold by any qualified jeweler. It is made with 92.5 percent silver, and 5 percent platinum by volume and 70 percent platinum by value. Because platinaire is less expensive than 14 karat gold, consumers can spend more on diamonds and still maintain their spending budgets, Weindling said.



A.G. WEINDLING

Platinaire, an alloy of silver and platinum, is taking the place of gold in designer jewelry.

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## Silver Investment Report Update Slated for September

The [Silver Institute](#) will issue a report in September titled *The Silver Investment Market – An Update*. The report will examine who is investing in silver, investment in paper instruments linked to silver, physical investment in Western and developing markets, silver mining stocks, and an analysis of privately-held silver bullion stocks. Additionally, the report will provide commentary on future trends in the components of silver investment demand. [GFMS Ltd.](#) has been commissioned to produce this report for the Silver Institute.

# Mystery Solved: How Nanosilver Occurs in Nature

Nature is producing its own silver nanoparticles.

Given an existing source of silver ions in the environment, naturally occurring humic acid – produced by the decay of organic matter – will produce stable silver nanoparticles, according to a team of researchers from the National Institute of Standards and Technology (NIST), Florida Institute of Technology (FIT), and the State University of New York (SUNY), Buffalo.

The findings may explain why silver nanoparticles have been found in areas such as old mining regions that are not likely to have been exposed to man-made nanoparticles, but have significant concentrations of silver ions.

“Our colleague, Virender Sharma, had read an article in which they were using wine to form nanoparticles. He thought that, based on the similar chemistry, we should be able to produce silver nanoparticles with humic acids,” said FIT chemist Mary Sohn. “First we formed them by traditional methods and then we tried one of our river sediment humic acids. We were really excited that we could see the characteristic yellow color of the nanoparticles.”

The team mixed silver ions with humic acid from a variety of sources at different temperatures and concentrations and found that acids from river water or sediments would form detectable silver nanoparticles at room temperature in as little as two to four days. In addition, the humic acid appears to stabilize the nanoparticles by coating them and preventing the nanoparticles from clumping together into a larger mass of silver.

“The findings may explain why silver nanoparticles have been found in areas such as old mining regions that are not likely to have been exposed to man-made nanoparticles, but have significant concentrations of silver ions.”

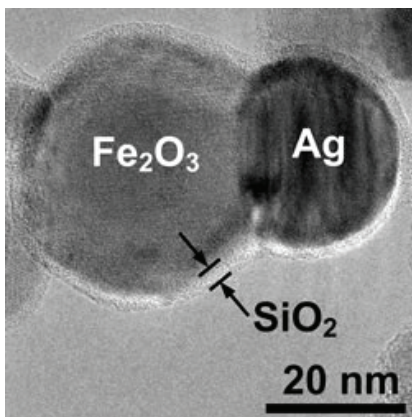
# Solving the Silver Sensor Puzzle

How do you use silver-based sensors to study bacteria if the silver kills the bacteria?

To solve this conundrum, scientists at ETH Zurich's Particle Technology Laboratory of the Institute of Process Engineering are preparing silver particles in a way that prevents them from releasing bacteria-killing ions but leaves their optical properties intact. This means the particles can be used in medicine as sensors to identify pathogens or for therapeutic purposes.

Using a special procedure, researchers coated silver nanoparticles with a two-nanometer thick layer of silicon dioxide. A completely coated particle offered the same optical characteristics prized in uncoated silver. Yet, because the silver ions can't penetrate the shell, the bacteria cells are not in danger. Scientists tested the coated silver particles in the presence of E Coli., which silver attacks vigorously under normal circumstances, and the microbe was unscathed.

The reason why silver is sought after for its optical properties is that when reflected light hits silver nanoparticles, the electrons oscillate in a way that is unique to the reflected surface. A certain bacteria, for example, could be detected based on how light reflects off its surface and on to the silver-based sensor. The characteristics are seen precisely and instantaneously.



ETH ZURICH

Special silver nanoparticles coated with silicon dioxide can be used to identify pathogens.

# FDA Approves Silver-Imbedded Face Mask

The U.S. Food and Drug Administration in April approved the SpectraShield single-use mask for health-care practitioners to protect against microorganisms, body fluids and particulate materials during a medical emergency. The N95 shield is coated with a silver-copper agent and embedded with zeolite, a mineral with absorbent properties.

Made by [Nexera Medical](#) in Fort Lauderdale, Florida, the mask blocks 95 percent of the bacteria that causes Methicillin-resistant *Staphylococcus aureus*, or MRSA, according to the company's tests which were submitted to the FDA. MRSA is a flesh-eating staph infection growing more common in hospitals and is very difficult to knock down with antibiotic drugs as the bacteria grows ever more resistant. The mask also blocks the bacteria responsible for strep throat, meningitis, tonsillitis and streptococcal toxic shock syndrome.

Everyday face masks do not filter out very small particles which are transmitted through the air by coughing or sneezing. These inexpensive masks also have gaps between the skin and mask allowing contaminants to reach the wearer's nose and mouth. The N95, which costs around \$5 each -- compared to a traditional mask at \$2 each -- fits tighter to the face, offering additional protection, company officials say.



NEXERA MEDICAL

This faceshield is imbedded with a silver-copper agent and protects against bacteria including life threatening MRSA, commonly found in healthcare facilities.

# Customized Silver-Containing Coatings Eliminate Implant Infections

About half of our bones are made up of a modified form of the inorganic mineral hydroxylapatite, also known as bone mineral, which is why it is used as filler material to replace missing bone during medical procedures such as melding prostheses to limbs. It also is used in dentistry where bones must be built up to accommodate implants.

Now, researchers at North Carolina State University are imbedding silver into hydroxylapatite-coated surgical implants to prevent rejection and infection. Afsaneh Rabiei and her team are using ion-beam assisted deposition to coat hydroxylapatite and silver onto metallic implants such as titanium, cobalt and chromium.

By adding two percent by weight of silver to the hydroxylapatite deposit, the combination eliminates the potential of rejection of a natural component of bone and at the same time provides silver's significant contribution in its action against such bacteria as *Staphylococcus aureus* and *Staphylococcus epidermis*.

Rabiei's team showed that the dense deposit of hydroxylapatite crystals by ion-beam deposition sticks well to titanium, cobalt, chromium, and other metal implants. Adhesion tests showed no separation of the coating from a titanium surface, for example, at a pull of 12,000 pounds per square inch. During deposition the hydroxylapatite layer becomes more amorphous, adsorbing proportionally more silver. This effectively clears bacterial infection from the area of the implant and provides antibacterial protection for the life of the coating.

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## Rubber Stamping Silver On Wounds Shows Promise

Researchers at the University of Wisconsin-Madison have found a novel way to apply silver particles to wounds: they're using a rubber stamp.

In order to employ the least amount of silver necessary to kill bacteria and promote healing, post doctorate fellow Ankit Agarwal and his colleagues created a transparent, ultra-thin polymer coating carrying a precise amount of silver nanoparticles. The coating was placed on a flexible piece of rubber and then stamped onto a cadaver skin that simulated a wound.

The study, published in the journal *Advanced Functional Materials*, showed that treated skin samples harboring two commonly-found wound bacteria were microbe-free within 12 hours.

The films containing silver nanoparticles are composed of hundreds of individual layers and take several hours to prepare on a robotic machine on campus, according to Agarwal. However, the stamping process itself takes just 30 seconds using a handheld roller like those used to make woodcut prints.

If the technology passes animal trials, researchers would like to move on to human trials. "The need is great, but it can take another few years before the treatment is available to patients," Agarwal said.

## Silver Ionic Liquids Help to Clean Petroleum Waste Water

For a long time, companies have been looking for a less expensive and energy intensive way to separate olefins and paraffin, two compounds found in petroleum waste streams, so the water can be recycled. The problem is that both compounds have similar boiling points and evaporation properties, so simple heat distillation doesn't work.

Now, silver complex-based ionic liquids may provide a solution. New research at Oak Ridge National Laboratory shows that olefins can be separated from paraffin efficiently and economically using silver complex-based ionic liquids. Room temperature ionic liquids are a promising class of novel materials because they are salts that are molten at or near room temperature. They are composed of ions rather than molecules and don't easily evaporate, which makes them potentially recyclable and environmentally friendly solvents.

The idea builds on recent strides in membrane technology that make it easier to transport olefins out of a waste stream. In this hybrid olefin-paraffin separation method, silver or copper ions are used to bind to olefin to form an ionic liquid. The silver or copper ions then act as carriers for the unwanted olefin molecules and transfer them through the membranes.

So far, more than 400 ionic liquids have been commercialized. These materials have a wide range of potential applications in the chemical industry, including the separation of petroleum by-products in the oil industry. The wide variety of materials that can be used to make ionic liquids enables scientists to choose the ones best suited for a particular application.



# Upcoming Events and Industry News

## Plan on Attending the 10th Annual China International Silver Conference (CISC)

The 10th annual China International Silver Conference (CISC) will be held in Chongqing from October 19 to October 21, 2011. Since 2002, the CISC has attracted global attention from key silver market participants every year. Attendees will include government officials, silver industry organizations, leading global silver mining companies, refiners, manufacturers, investors and traders. The CISC has become the most important international silver conference in the world for market participants and offers attendees an excellent forum for networking and learning more about the increasingly important role that China plays in the silver market.

The conference is open to everyone, and foreign participation is greatly encouraged by the conference organizers and sponsors. China is now the world's third largest producer of silver. Building on this trend, the conference will offer abundant opportunities for business leaders to forge new relationships and increase product sales and investment opportunities.

Conference registration will take place on October 19, with a reception that evening. The speakers' program will encompass a full day on October 20 and a half-day on October 21. The CISC conference site is located twenty minutes from Chongqing airport.

More details on the conference, including speakers, will be announced soon. In the meantime, for more information, visit the conference web site at: <http://www.china-silver2011.com/en/>

## Applied Nanotech Holdings Opens Solar Inks Line

[Applied Nanotech Holdings, Inc.](#) has launched its new solar inks pilot manufacturing line at a newly-extended facility in Austin, Texas. Applied Nanotech's nanoparticle ink technology formulations of aluminum, copper, nickel and silver will be delivered using aerosolized jet, inkjet and spray coating methods and other non-contact printing techniques that will enable ultra-thin silicon wafers to be used for photovoltaic applications.

Using methods such as inkjet, aerosol jet and spray coating – all non-contact methods – allows solar companies to save material costs on the amount of silicon used by enabling the use of thinner wafers.

Larry Kahaner  
Editor

[www.silverinstitute.org](http://www.silverinstitute.org)

## Coeur d'Alene Mines Receives Five Mine Safety Awards

The International Society of Mine Safety Professionals (ISMSP) has awarded [Coeur d'Alene Mines](#) with five national and international safety awards for its operations in North and South America.

The awards were for:

- Coeur Rochester Mine, Lovelock, Nevada, 3 years and 348,884 employee hours worked without experiencing a lost time accident.
- Coeur Alaska Kensington Mine, Juneau, Alaska, 3 years and 757,664 employee hours worked without experiencing a lost time accident.
- Coeur South America Exploration, Santiago, Chile, 5 years and 520,110 employee hours worked without experiencing a lost time accident.
- Coeur Exploration, Temoris, Chihuahua, Mexico, 3 years and 162,988 employee hours worked without experiencing a lost time accident.
- Coeur Argentina Exploration, Gregores, Santa Cruz, Argentina, 2 years and 28,554 employee hours worked without experiencing a lost time accident.

[The International Society of Mine Safety Professionals](#) is an organization dedicated to promoting the development of health and safety professionals throughout the international mining community. The achievements in safety are awarded at the ISMSP annual professional conference. The awards are for the year that ended December 31, 2010.

## PPG's New Silver-Coated Starfire Glass Lets in More Light

[PPG Industries](#) has introduced *Solarban 72 Starphire* glass, a solar control, low-emissivity glass designed to provide high visible light transmittance, exceptional clarity and superior solar control performance, according to company officials. The glass has a triple silver coating and one layer of uncoated Starphire glass.

*Solarban 72 Starphire* glass has solar control characteristics that are similar to those of *Solarban 70XL* glass, the industry's first triple-silver-coated, solar control, low-e glass, but it transmits 11 percent more natural light.

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