THE SILVERINSTITUTE

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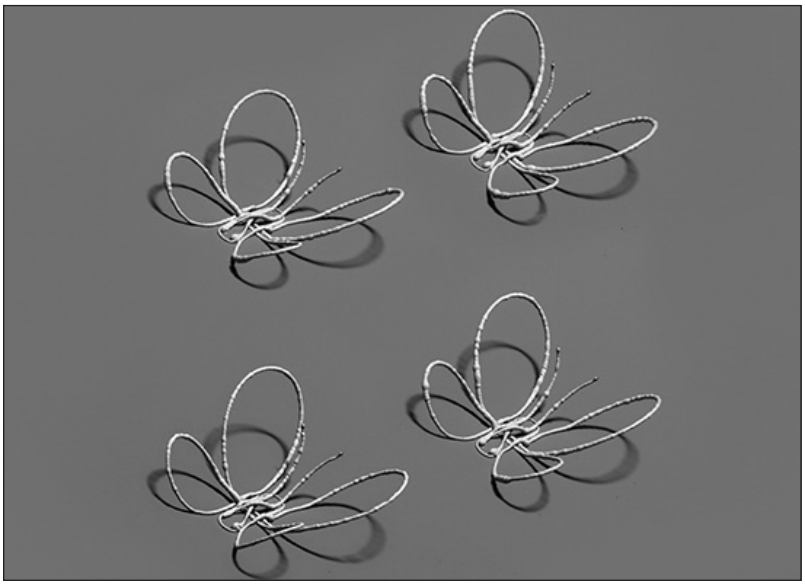
Silver News

3D Printing in Mid-Air Allows Intricate Designs from Silver Ink

Innovative Medical Devices a Key Beneficiary



LEWIS LAB / WYSS INSTITUTE AT HARVARD UNIVERSITY

These 3D butterflies were printed in mid-air out of silver nanoparticles. Click the image to watch the printer in action.

Using an ink composed of silver nanoparticles, researchers at Harvard University are producing intricate shapes suspended in the air without the need for any support or armature.

This method, using 3D printers, will allow scientists to make flexible products such as wearable electronics, sensors, antennas and medical devices that can be narrower than a human hair and completed in a matter of seconds.

"I am truly excited by this latest advance from our lab, which allows one to 3D print and anneal flexible metal electrodes and complex architectures 'on-the-fly,'" said Jennifer Lewis, the Hansjörg Wyss Professor of Biologically Inspired Engineering at the John A. Paulson School of Engineering and Applied Sciences at Harvard.

The nanosilver ink is ejected through a printing nozzle at exactly the right amount and period of time so that it solidifies without dripping or sagging. The process is controlled by a laser that manages the heating of the shape being produced so that it will anneal on cue. The challenge, researchers said, was to find the correct nozzle-to-laser separation distance. When the laser got too close to the nozzle, the ink got clogged. When it was too far, the shape didn't dry fast enough to maintain the desired shape.

"This sophisticated use of laser technology to enhance 3D printing capabilities not only inspires new kinds of products, it moves the frontier of solid free-form fabrication into an exciting new realm. This demonstrates once again that previously accepted design limitations can be overcome by innovation," said Wyss Institute Director Donald Ingber, in a prepared statement.

Exceptional Growth in Key Sectors Leads to Record High Silver Demand in 2015

Jewelry, Coin and Bar, and Photovoltaic Demand Reach Historic Levels

The silver market saw record demand in 2015, with the jewelry, coin and bar, and photovoltaic sectors posting new highs, helping to boost total silver demand to 1.17 billion ounces last year, according to *World Silver Survey 2016,* published in May. Last year's supply and demand scenario led to the third successive annual silver market deficit, reaching 129.8 million ounces, more than 60 percent larger than 2014 and the third largest on record.

The *World Silver Survey* is published by the Silver Institute and is produced on its behalf by the GFMS Team at Thomson Reuters. The Survey has been published since 1990.

Highlights

Silver Demand

Globally, silver jewelry fabrication increased for the third consecutive year to post a new high at 226.5 million ounces. This increase was largely achieved on the back of a 16 percent rise from both India and Thailand, while North America posted a 5 percent annual increase. Total silverware fabrication logged its third successive annual rise to an estimated 62.9 million ounces, a ten-year high.

The largest component of physical silver demand, industrial applications, accounted for 50 percent of total physical silver demand last year and was 4 percent lower, totaling 588.7 million ounces. This drop was largely due to weaker fabrication demand in developing countries and a stagnant global economy. On a regional basis, modest increases in industrial demand were posted in the United States and Japan, the second and third largest sources of industrial demand, respectively.

Silver demand for photovoltaic applications rose 23 percent in 2015 to 77.6 million ounces, marking the second consecutive year of increases in this sector, driven by strong growth in Chinese solar panel installations. Silver demand for ethylene oxide (EO) grew 103 percent to 10.2 million ounces.

Silver Supply

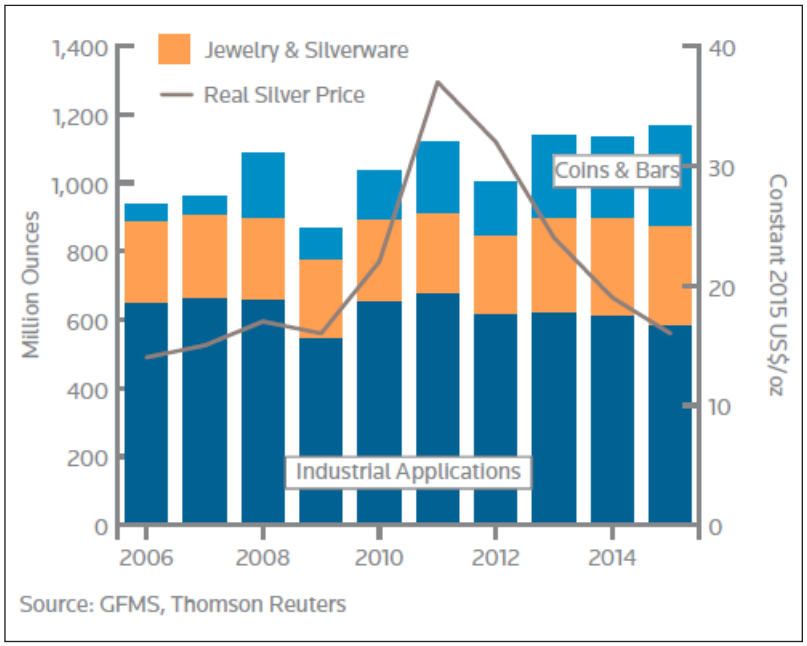
Global silver mine production growth slowed to 2 percent in 2015 and reached a record 886.7 million ounces. The mine production growth was attributable to stronger output in Peru, Argentina, Russia and India. Canada, Australia and China had lower mine production, with the latter decreasing output by 3 percent. Primary silver mine production grew 5 percent, and accounted for 30 percent of global silver mine supply.

Scrap supply was down by 13 percent to 146.1 million ounces, the lowest volume level since 1992 and the fourth consecutive year of decline.

Silver Investment & Price

Physical bar investment, coins and medals, and exchange traded products, climbed 16 percent to a near record high in 2015. Silver coin and bar investment rose 24 percent to 292.3 million ounces, the highest annual demand level in GFMS' records, overtaking the previous high in 2013. Coin and bar demand accounted for 25 percent of total physical demand in 2015, the highest market share on record and up from just 5 percent a decade earlier. Silver coin and medal demand amounted to 134.1 million ounces of demand last year due to unprecedented growth in several key markets, notably the United States and India.

For a free downloadable PDF of *World Silver Survey 2016* go to the Silver Institute's home page at www.silverinstitute.org.



The largest contributor to total demand growth was coin and bar investment, which grew 24 percent last year to a record 292.3 million ounces.

Medical Center Installing Silver-Copper Ionization Water System to Keep Legionnaires' Disease at Bay

The Wake Forest Baptist Health – Lexington (NC) Medical Center is installing a silver-copper ionization water purification system after finding evidence of Legionnaires' Disease (Legionella bacteria) in the facility's water supply.

Silver-copper ionization is a common treatment for bacteria like Legionella that have infiltrated pipes, pumps, water towers and other components of building water supplies. Although water containing Legionella is usually not harmful if drunk the disease causes respiratory distress and is spread through water droplets that are small enough for people to breath in, according to the U.S. Center for Disease Control. Exposure can occur from spray from an infected hot tub, or tiny droplets that have bounced off a water fountain basin. CDC also reports exposure when water "goes down the wrong pipe," into the trachea (windpipe) and lungs instead of down the digestive tract.

The bacteria, which is particularly virulent for people with compromised immune systems, has not caused any reported injuries at the Medical Center and the silver-copper ionization equipment will be installed as a cautionary measure, hospital officials said.

Legionnaires' Disease was named after an outbreak of a then-unknown malady that sickened more than 200 people and caused 34 deaths among attendees at a convention of the American Legion, an association of U.S. military veterans, in Philadelphia in July 21–24, 1976.

WAKE FOREST BAPTIST HEALTH

The Wake Forest Baptist Health – Lexington Medical Center is installing a silver-copper water ionization system after detecting Legionnaires' Disease in the water supply.

The 20th National Silver Competition of Peru

José Sullon, a filigree silversmith from Catacaos, Piura, in northern Peru, has won the 20th National Silver Competition organized by Patronato Plata del Perú with his MP3 device and a speaker. The Silver Institute has been a longtime supporter of the Patronato, which seeks to increase silver jewelry demand in this important silver-mining country. The installation used soldiered silver threads and laminated engraved plaques and played Christian folk music accompanied by intermittent disco lights.

The winning piece in the jewelry category was a necklace showing the wings of a condor expanded in two shades of silver. The winner in the silversmith's category offers a tribute to 19th century automatons. It is playful image that evokes the longing of people to fly.

In all, 130 pieces were brought from distant cities of Peru, showing the various techniques and skills of Peruvian silversmiths, as well as the traditions and history of the country.

HTTP://PLATADELPERU.ORG

This MP3 player and speaker won the 20th National Silver Competition organized by Patronato Plata del Perú. Click image to watch the video.

European Consumer Safety Group Okays Silver-Based Preservative for Cosmetic Containers

The European Commission's Scientific Committee on Consumer Safety (SCCS) has concluded that the silver-containing preservative/antibacterial EcoG+ is safe for use as a component in packaging material for cosmetics – at a maximum concentration of 2%.

EcoG+ is a composite material consisting of three components: silver-containing phosphate glass powder, a polymer and glass beads. EcoG+ acts as an inert carrier into which silver ions are dispersed to act as a preservative/antibacterial for the cosmetics.

The SCCS is one of three non-food scientific committees that provide the European Commission with the scientific advice it needs when preparing policy and proposals relating to consumer safety, public health and the environment. It also draws the Commission's attention to new or emerging problems that may pose an actual or potential threat.

EcoG+ is a patented technology from cosmetic applicator maker Taiki Group that increases antimicrobial protection and allows preservatives to be reduced or eliminated from product formulas, according to company officials. EcoG+ is registered with the U.S. Environmental Protection Agency.

TAIKI GROUP

EcoG+ helps keep bacteria from growing on cosmetic applicators. For a video on how EcoG+ works, click the image.

Antibacterial Glass Market Poised for Growth: Report

The antibacterial glass market will grow from $US160 million in 2015 to over $US270 million in 2023, according to a study just published by Global Market Insights, Inc.

Because of its low toxicity to humans, silver remains the preferred active ingredient for antibacterial coatings, the report noted.

The prime reason for expected growth of the antibacterial glass sector is the increasing prevalence of hospital-acquired infections that will drive the global antibacterial glass market over the next few years. "Hospitals continued to dominate the antibacterial glass market share in 2015, with more than $US68 million in revenue; isolation rooms, burn units, hematology and oncology units are key application areas. Antibacterial glass provides an architectural solution to these ailments and can be used in furniture, partitions, and intensive care units among others. This segment is expected to grow significantly over the forecast time-scale. Companies looking to venture into the market have been targeting hospitals as the preferred end-use industry due to the high expected demand for antibacterial glass in this sector," the report stated.

Key findings include:

- Global antibacterial glass market will grow at a 6.9% compound annual growth rate (CAGR), and looks poised to exceed $US270 million by 2023.
- Silver antimicrobial glass is forecast to see revenue exceeding $US253 million by 2023, which would be more than 93% of the global earnings at that time.
- Food & beverage applications will continue to be attractive, with growth forecast at 7.1% CAGR from 2016 to 2023. These products facilitate storage for a prolonged period of time by suppressing the propagation of bacteria and other microorganisms in glass containers. Besides being used for storage, these are also used in restaurants, canteens and food show cases.
- In military settings, where equipment needs to be kept sterile and sanitary despite volatile working conditions, antibacterial glass and coatings have been gaining importance. Electronics, automotive, construction and personal care are among the emerging applications for this industry.
- Europe's antibacterial glass market size was $US97.5 million in 2015. The region is heavily regulated, with standards such as EN 13697, EN 1276, and EN 1650 in place to evaluate the bactericidal and fungicidal properties of chemical disinfectants used in the food industry.
- Global antibacterial glass market share is dominated by a few suppliers such as AGC Glass Europe, Saint-Gobain, Nippon Sheet Glass, etc. AGC is integrated across the value chain, and provides an end-to-end solution, from glass production to distribution.

Silver Compounds Could Replace Toxic Material in Fluorescent Lights

An international group of scientists have incorporated silver atoms into zeolite – found in many laundry detergents – and found that the resulting compound emits light, which may lead to less toxic bulb materials such as those used in fluorescents lights.

"The high efficiency of the materials along with cheap, scalable synthesis makes them very attractive as next-generation emitters for fluorescent lamps, LEDs and for biological imaging to highlight tumors or cell division," said Oliver Fenwick from Queen Mary University of London School of Engineering and Materials Science. "We've shown that silver atoms can be assembled in the porous framework of minerals known as zeolites with a level of control not reported previously. This has allowed us to tailor very precisely the properties of the silver clusters to meet our needs – in this case an efficient phosphor."

The research, published in the June 6, 2016 issue of the journal *Nature Materials*, was funded by the European FP7 project "Self-assembly in confined space" and involved the Université de Strasbourg in France and KU Leuven in Belgium. FP7 was the European Union's Research and Innovation funding program for 2007-2013. Many of its studies, like this one, are still running.

Upcoming Events

15th China International Silver Conference

The 15th China International Silver Conference 2016 (CISC) will be held September 26-28, 2016, in Guangzhou, China. Guangzhou is easily accessible from Beijing, Hong Kong and Shanghai.

The CISC is the most prominent global international silver conference and offers attendees an opportunity to meet with key Chinese and international silver market participants. This year, over 450 attendees are expected to attend.

For more information, including registration materials, agenda and speakers, hotel, as well as other activities, please click here.

Larry Kahaner
Editor

www.silverinstitute.org
@SilverInstitute on Twitter

THE SILVERINSTITUTE
1400 I Street, NW, Suite 550
Washington, DC 20005
T 202.835 0185
F 202.835 0155