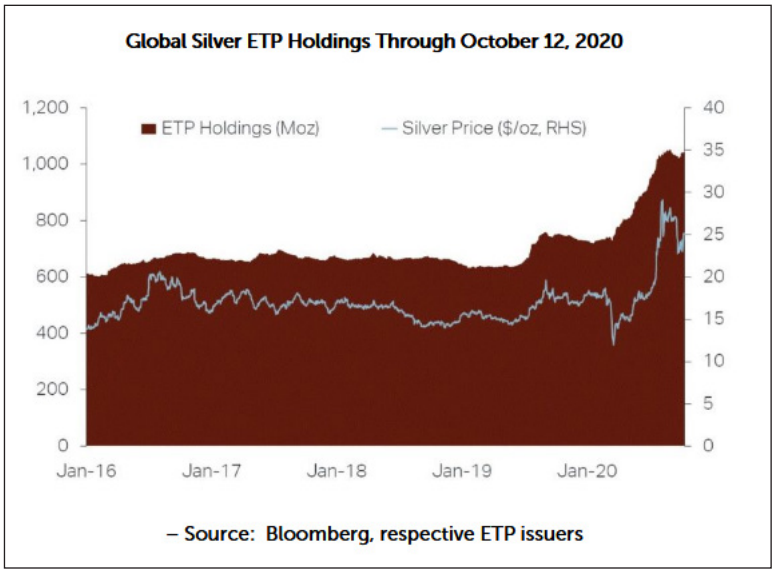
THE SILVERINSTITUTE

October 2020

Silver News

Silver Exchange Traded Product Holdings Nearly Triple in First Three Quarters of 2020 Compared to Same Period Last Year



"Globally, silver bullion coin demand is up strongly, with a 65 percent increase in demand over the first three quarters of 2020."

Global silver Exchange Traded Product (ETP) holdings rose by 297 million ounces (Moz) through the third quarter of this year, nearly tripling the growth in the comparable period last year (297 Moz vs. 103 Moz). ETP holdings through the end of September stood at 1.026 billion ounces (Boz), slightly off the high of 1.052 Boz recorded in August, according to an analysis published by The Silver Institute. Global ETP holdings are on an upward trajectory in the 4th quarter, and as of the October 23rd, were over 1.045 Boz, slightly off the high registered in August.

Globally, silver bullion coin demand is up strongly, with a 65 percent increase in demand over the first three quarters of 2020. This was due to strong sales in two key bullion coin markets, the U.S. and Germany, with both seeing substantial double-digit gains over the first nine months.

Silver bar demand has also risen sharply this year, led again by the U.S. and Germany. This growth has been partly offset by weaker demand in India, particularly in recent months where price-led liquidations have occurred.

There were indications of a partial recovery in global industrial demand during the third quarter with further momentum gains going into the fourth quarter. Even so, and entirely as a result of the COVID-19 pandemic, silver industrial offtake is forecast to soften this year by around 10 percent year-on-year.

For further details visit The Silver Institute website.

Printing Silver-Based Sensors Directly onto Skin Without Heat; A Goal for Wearables Becomes Reality

Current printing methods to layer molten metals on electronic circuit boards involve 'sintering,' a process that heats the metal, usually silver powder, to high temperatures before sputtering it onto the board. If this process could be done at room temperature, it would catalyze a new world of wearable sensors that could literally be tattooed onto a person's skin.

Penn State researchers say they have accomplished this goal.

Sintering usually takes place at temperatures as high as 572 degrees F (300 degrees C) which can burn skin. By adding a 'sintering aid layer,' the Penn State scientists are able to print electronic components directly onto human skin without harming the person.

The sintering aid layer consists of polyvinyl alcohol paste, used in peelable face masks, and calcium carbonate, the main ingredient in eggshells. "The layer reduces printing surface roughness and allows for an ultrathin layer of metal patterns that can bend and fold while maintaining electromechanical capabilities," said Huanyu Cheng, Dorothy Quiggle Career Development Professor in the Penn State Department of Engineering Science and Mechanics, in a prepared statement. "When the sensor is printed, the researchers use an air blower, such as a hair dryer set on cool, to remove the water that is used as a solvent in the ink."

He added: "The outcome is profound. We don't need to rely on heat to sinter."

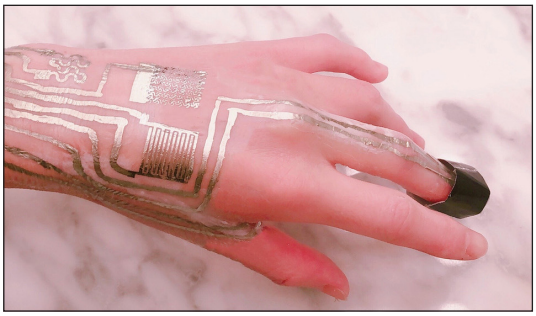
The silver sensors that Cheng and his international team have printed on skin using their ambient temperature sintering technique have been able to monitor temperature, humidity, blood oxygen levels and electrical signals from the heart.

Cheng concluded: "The sensor can be recycled, since removal doesn't damage the device. And, importantly, removal doesn't damage the skin, either. That's especially important for people with sensitive skin, like the elderly and babies. The device can be useful without being an extra burden to the person using it or to the environment."

The researchers hope to use their technology for specific applications such as monitoring symptoms of COVID-19.

The work was supported by Penn State University, the U.S. National Science Foundation, the American Chemical Society Petroleum Research Fund, the Shenzhen Science and Technology Program, the Bureau of Industry and Information Technology of Shenzhen and the National Science Foundation of China.

"The sensor can be recycled, since removal doesn't damage the device. And, importantly, removal doesn't damage the skin, either." – Prof. Huanyu Cheng



LING ZHANG, PENN STATE/ CHENG LAB AND HARBIN INSTITUTE OF TECHNOLOGY

An international team of researchers printed silver-based sensors directly on human skin at room temperature.

A New Method for Making Silver Ion Infused Glass Helps Study Tiniest Substances

There are multiple ways to imbed silver ions on glass including lithography, depositing particles from silver solutions like silver nitrate, and using chemical or thermal infusion. While these methods are effective, they don't allow precise placement of silver ions into shapes that permit the glass to be used in Raman Spectroscopy – a technique that allows scientists to study infinitesimally small crystal structures, chemical composition and a host of other characteristics of a substance.

Using an infrared laser technique, scientists at Peter the Great St. Petersburg Polytechnic University, Russia (SPbPU) have been able to produce glass with silver ions in precise configurations that allow the use of Raman Spectroscopy. This is vitally important to researchers because it allows them to study even the tiniest amount of a substance. This method amplifies the material's characteristics that would normally not be visible with other methods including conventional electron microscopes. "Notably, the signal enhancement increases 10^5 to 10^6 times. This is a huge gain," said Professor Andrey Lipovskii of SPbPU. His team collaborated with others from Alferov University, Institute of Problems of Mechanical Engineering, Russian Academy of Science and University of Technology of Troyes, France.

Another advantage of this infrared laser technique is that it produces glass with silver ions that is sturdy, not fragile like other silver-infused glass. This allows the glass to be carried into the field for testing on site without concern for damaging it, Lipovskii added.

Micro-Engraving Gives British Royal Mint Bullion Coins Extra Security

The Royal Mint has produced what it considers the world's most 'visually secure' bullion coins for its silver and gold products. The new features, which can be seen by the naked eye, but are almost impossible to reproduce, will be included starting with the 2021 Britannia coins, according to British mint officials.

The security features include:

- Latent image: The latent image acts like a hologram and changes from a padlock to a trident when the coin is viewed from different angles.
- Surface Animation: Micro details on the coin combine to create the illusion of waves rolling behind the figure of Britannia. These are created using advanced picosecond lasers, and come to life as the coin is rotated.
- Micro-text: The addition of the Latin phrase DECUS ET TUTAMEN, which translates to "an ornament and a safeguard," surrounds the figure of Britannia and is created using specialty lasers.
- Tincture lines: To reinforce security, the Royal Mint has reintroduced the traditional art of tincture lines depicting colors and patterns on metal.

The visual safeguards are etched into the coins using advanced lasers like those used in medicine and aerospace applications. The micro-engravings are 200 times thinner than a human hair, Mint officials say.

The only silver coins with the safeguards will be the Britannia 2021, 1-ounce, £2 face value silver bullion coin composed of .999 fine silver. The retail price will be about £25. The obverse features Queen Elizabeth II and the reverse shows Britannia in a flowing gown.

ROYAL MINT

This 1-ounce silver bullion coin, part of the UK's Britannia collection, is made more secure by visual safeguards.

Silver-Based Antibacterial, Antiviral Flight Crew Uniforms Introduced

Keyvan Aviation of Istanbul, a corporate jet management company, has reportedly produced the world's first airline antibacterial and antiviral crew uniform.

The uniforms are made from 97% cotton and are imbedded with silver ions. The fabric maintains its antimicrobial properties even after washing 100 times at 140 degrees F (60°C), the company notes.

In an interview with Sam Chui Aviation & Travel, Chairman & CEO Mehmet Keyvan said that the antibacterial uniforms may appear like a departure from the company's normal product line, but the clothing is an extension of their services. "Keyvan Aviation started with the aim of offering luxury and quality services to the world of aviation and from the beginning the company started with two main departments, aero fashion and business jets."

He added: "Since there is no fashion company providing uniforms for cabin crews, and most airlines are looking for well-known fashion freelance designers to order their designs from, we decided to run our own aero fashion department including our in-house design team.

Because of the grounding of many planes during the pandemic, some airlines are slow to embrace the new uniforms, Keyvan said. "Because of the COVID-19 situation airlines around the world are facing financial difficulties. Since this product is not about luxury and is more about keeping people safe, we are discussing with our customers how to support them in these difficult days. The product has only been launched very recently, and we have received a good amount of interest from airlines and airports. We are currently negotiating with them to meet their requirements."

KEYVAN

This silver-based antibacterial and antiviral flight crew uniform provides in-flight safety for crew and passengers.

Tiny Silver Fibers in Masks Can Check for Breathing Problems;

Sense Proper Mask Positioning and Fit

With many people wearing face coverings because of the COVID-19 pandemic, what if a doctor could be alerted to danger signals such as shortness of breath sent directly from a face mask through a smartphone or home Wi-Fi?

Scientists at the University of Cambridge United Kingdom are helping to make this diagnostic device possible by producing fiber sensors, made from silver and semiconducting material so microscopically thin and sensitive to smell, odor, moisture and touch that they can be imbedded into face masks.

Andy Wang, a PhD student from Cambridge's Department of Engineering, and his colleagues used one of these 3D-printed fiber sensors to assess the amount of breath moisture leaked through a face covering. This could indicate difficulties such as rapid or shallow breathing and coughing. He noted that the sensors not only outperformed commercial sensors but were especially accurate at monitoring rapid breathing, which indicates shortness of breath.

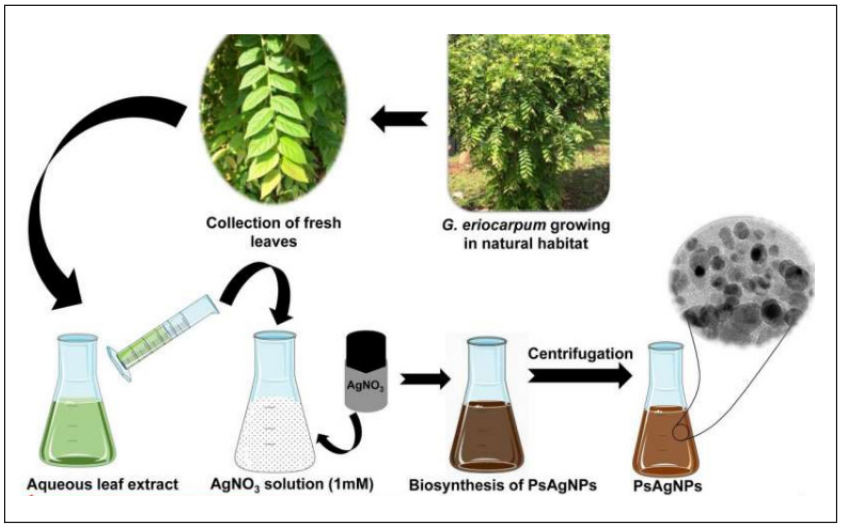
Wang's team suggested that although the sensor was not designed to detect viral particles, such as those that carry COVID-19, it could detect leakage points in masks by measuring the amount and direction of breath moisture. For example, they found that regular cloth masks leak mainly from the front, especially, and not surprisingly, from coughing. The healthcare worker standard N95 masks leak mainly from the top and sides. The sensors could not only make sure that people are positioning their masks correctly but also tightly enough.

"Our fiber sensors are lightweight, cheap, small and easy to use, so they could potentially be turned into home-test devices to allow the general public to perform self-administered tests to get information about their environments," said Yan Yan Shery Huang from Cambridge's Department of Engineering, who led the research, in a prepared statement.

Silver Nanoparticles from Shrub Help Produce Eco-Friendly Pesticide

Scientists at the Xishuangbanna Tropical Botanical Garden, Yunnan Province, China (XTBG) have synthesized silver nanoparticles using the leaf extract of a traditional medicinal shrub which has been shown to be effective against termites and other pests by attacking the insects' digestive systems.

The leaves are added to a solution of nitrate and silver nanoparticles are extracted through a process known as biosynthesis.



PHYS.ORG

"The integration of nanotechnology for efficient pest management is gaining momentum to overcome the challenges and drawbacks of traditional approaches," researchers led by Prof. Yang Xiaodong, principal investigator of the study, wrote in their paper. "However, studies pertaining to termite pest control using biosynthesized nanoparticles are seldom seen."

The shrub used in these experiments is the *Glochidion eriocarpum*, whose roots and leaves are employed as traditional remedies for toothache, dysentery, skin eczema and other maladies.

The paper noted: "Altogether, our preliminary study suggests promising potentials of PsAgNPs (plant-based silver nanoparticles) for pest management in forestry and agriculture sectors to prevent damages to living trees, wood, crops, etc. As sustainable pest management practices demand low risk to the environment as well as biodiversity, we recommend that more extensive studies should be performed to elucidate the environmental compatibility of PsAgNPs."

The paper was published in the *Journal of Hazardous Materials*.

Funding came from the Welsh Government and Swansea University.

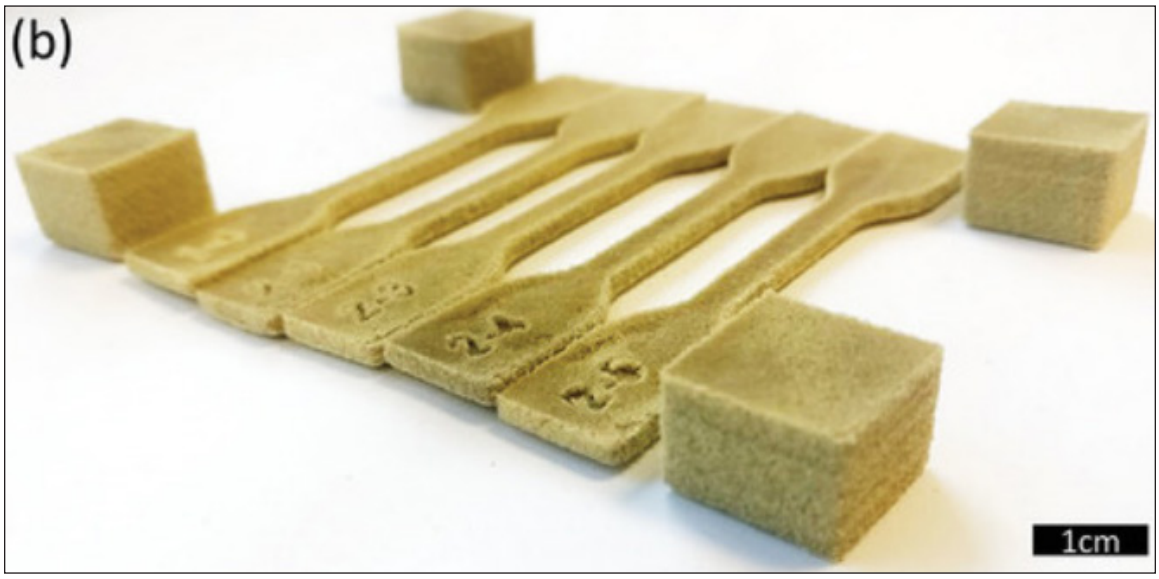
Silver Offers New Colors to Plastic Cases Printed by 3D Machines

A rapid 3D printing technique known as Laser Powder Bed Fusion or LPDF is a common method for quickly producing cases and cabinets for electronic devices like smartphones or conventional printers, but it has a drawback. It can only print black plastic.

Now, researchers at the University of Duisburg-Essen, Germany, have discovered that by introducing small amounts of nanosilver into the thermoplastic polyurethane powder used for printing they can produce yellow-colored housings and perhaps additional colors by varying the amount of silver.

"The use of inexpensive and compact diode lasers for LPBF in the visible or near-infrared range is highly desired, but at present, only black objects can be printed by desktop laser printers," the researchers wrote in their published paper. "In this study, we have presented a new way for colored parts to be produced through laser 3D printing."

Previous experiments showed that nanogold will also change the housing's color, but silver is less expensive and less prone than gold particles to clumping. Because the nanoparticles sit on the surface of the powder grains and not just mixed in, the colors also are homogenous.



ADVANCED OPTICAL MATERIALS JOURNAL

Silver nanoparticles allow 3D-printed plastics to go beyond black or white. Yellow is shown here and other colors may be possible in the future.

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