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NEWSLETTER

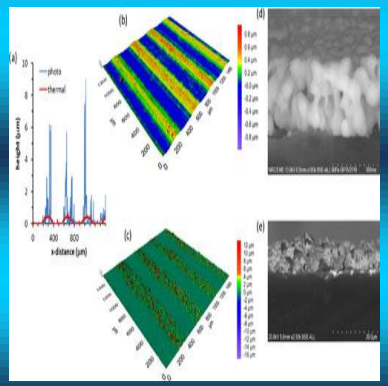
Srinivas Institute of Technology, Department of Nano Technology,

Engineering (B.E.) in Nano Technology, Mangalore, Karnataka, India.

ADVANCEMENTS IN NANO TECHNOLOGY

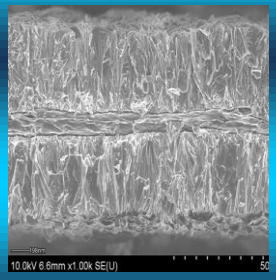
A silver molecular ink platform formulated for screen, inkjet, and aerosol jet printing

Researchers in Canada have demonstrated a screen-printable molecular ink that can be processed using both heat (thermal sintering) and light (photonic sintering) and can produce traces with submicron thicknesses and line widths as narrow as 41 µm. Printable electronics, an additive manufacturing technology, combines electronic materials with conventional printing processes to enable large-area, flexible, and/or low-cost manufacturing of membrane switches, TFTs, and sensors as well as photovoltaics, antennas, and OLED-based displays. Conductive inks make up one of the largest markets in printed electronics as they enable the fabrication of key elements such as electrodes, antennas, and bus bars for current collectors using gravure, aerosol jet, inkjet or screen printing. The printed electronics industry is driven, in part, by a desire to exploit additive manufacturing to reduce cost, and simply decreasing the silver content and the resulting trace thickness is an obvious means of achieving that goal. However, there are practical limitations in achieving high conductivity and mechanical robustness with flake-based inks because the traces require overlap of multiple layers of silver flakes and minimum thicknesses of ~4 µm. In their paper, the researchers present the development of a new class of screen-printable inks that make use of metal carboxylate salts as the silver metal precursor combined with a polymer binder to enable excellent screen printability, resolution, and mechanical properties of the conductive traces. In addition, the silver molecular ink serves as a platform that can be easily tailored toward inkjet and aerosol jet printing to make low-resistivity traces (2x bulk) and TFT electrodes. Such a platform is not feasible with flake-based inks because of particle size limitations, leaving only relatively expensive nanoparticle inks as an alternative. Despite the sub-micrometer thickness of the processed traces, the molecular ink can be printed on top of rough dielectric surfaces to produce functional metal-insulator-metal devices in a production environment. Finally, the ink serves as a platform technology where all of the required components from the screen-printable ink can be incorporated into inks compatible with inkjet, aerosol spray, and screen printing, enabling many applications and devices (such as transistors) under development in printable electronics.



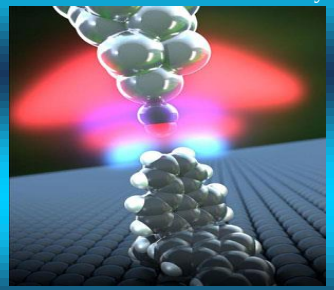
Electroplating delivers high-energy, high-power batteries

The process that makes gold-plated jewelry or chrome car accents is now making powerful lithium-ion batteries. Researchers developed a method for electroplating lithium-ion battery cathodes, yielding high-quality, high-performance battery materials that could also open the door to flexible and solid-state batteries. This is an entirely new approach to manufacturing battery cathodes, which resulted in batteries with previously unobtainable forms and functionalities. Traditional lithium-ion battery cathodes use lithium-containing powders formed at high temperatures. The powder is mixed with glue like binders and other additives into slurry, which is spread on a thin sheet of aluminum foil and dried. The slurry layer needs to be thin, so the batteries are limited in how much energy they can store. The glue also limits performance. The glue is not active. It doesn't contribute anything to the battery, and it gets in the way of electricity flowing in the battery. This inactive material taking up space inside the battery, while the whole world is trying to get more energy and power from the battery. The researchers bypassed the powder and glue process altogether by directly electroplating the lithium materials onto the aluminum foil. Since the electroplated cathode doesn't have any glue taking up space, it packs in 30 percent more energy than a conventional cathode, according to the paper. It can charge and discharge faster as well, since the current can pass directly through it and not have to navigate around the inactive glue or through the slurry's porous structure. It also has the advantage of being more stable.



Hydrogen bonds directly detected for the first time

For the first time, scientists have succeeded in studying the strength of hydrogen bonds in a single molecule using an atomic force microscope. Hydrogen is the most common element in the universe and is an integral part of almost all organic compounds. Molecules and sections of macromolecules are connected to one another via hydrogen atoms, an interaction known as hydrogen bonding. These interactions play an important role in nature, because they are responsible for specific properties of proteins or nucleic acids and, for example, also ensure that water has a high boiling temperature. To date, it has not been possible to conduct a spectroscopic or electron microscopic analysis of hydrogen and the hydrogen bonds in single molecules, and investigations using atomic force microscopy have also not yielded any clear results. Researchers now succeeded in using a high-resolution atomic force microscope to study hydrogen atoms in individual cyclic hydrocarbon compounds. In close collaboration with colleagues from Japan, the researchers selected compounds whose configuration resembles that of a propeller. These propellanes arrange themselves on a surface in such a way that two hydrogen atoms always point upwards. If the tip of the atomic force microscope, which is functionalized with carbon monoxide, is brought close enough to these hydrogen atoms, hydrogen bonds are formed that can then be examined. Hydrogen bonds are much weaker than chemical bonds, but stronger than intermolecular van der Waals interactions. They show that the interaction clearly involves hydrogen bonds. The measurements mean that the much weaker van der Waals forces and the stronger ionic bonds can be excluded.



Nano products

POWERnANO premium

The product is from Vadlau GmbH company, Astria. This this product is used to coatings for metal and ceramic sinks, bathtubs, shower enclosures, glazed ceramic tiles, outdoor furniture, plastic and glass products, and home appliance maintenance. Some nanoparticles are used to enhance the properties of the coating.

Air Purifier, Dr. Mobile

The product is from Airo Co., Ltd., Korea. Nano silver filter, the best antibacterial filter produced with nanotechnology, prevents growth of, and kills approximately 650 kinds of harmful germs and viruses with a germ resistance rate of 99.9%. This filter protects functions of other filters such as the carbon filter by getting rid of relatively large particles and by preventing the growth of germs. This top quality deodorant filter gets rid of foul smells of cigarette smoke, foods, and mildew as well as chemicals generated from solvents such as benzene and ammonia, while it captures dioxin, a carcinogen. Unlike other existing deodorants, chlorine dioxide directly dissolves matters that cause foul smells, removes germs, mildew, viruses, and bacteria in the air, and oxidizes harmful gases such as ammonia and hydrogen sulfide to remove them.

EDITORS

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