NEWSLETTER

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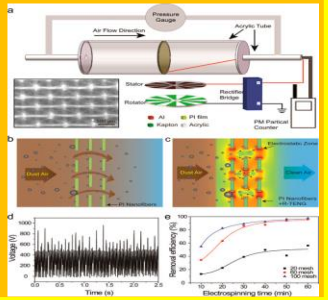
ADVANCEMENTS IN NANO TECHNOLOGY

Removing air pollution with nanogenerator-enhanced air filters

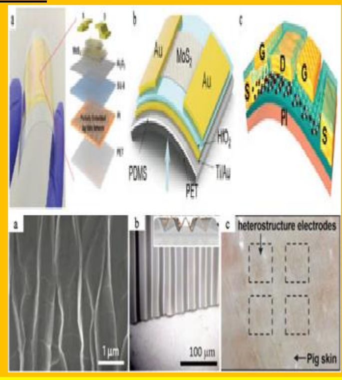


A triboelectric nanogenerator (TENG) is a device that converts mechanical energy into electricity using the coupling effects between triboelectrification and electrostatic induction through the contact separation or relative sliding between two materials that have opposite tribo-polarity. TENGs utilize charges arising from friction similar to the static we experience on dry winter days. Going back to the 18th century, Benjamin Franklin found that when a piece of glass and a piece of silk cloth, neither of which exhibit any electrical properties, attract each other after rubbing against each other due to the buildup of charges. In other words, a TENG is based on a physical process of converting mechanical agitation to an electric signal through the triboelectrification (in the inner circuit) and electrostatic induction processes (in the outer circuit). Researchers have now utilized a rotating triboelectric nanogenerator (R-TENG) to enhance a polyimide (PI) nanofiber air filter for particulate matter (PM) removal. As the team demonstrates, their PI nanofiber filter exhibited high removal efficiency for the PM particles with diameter larger than 0.5 µm. When working with the R-TENG, the removal efficiency of the filter is enhanced, especially in the region with the diameter of the particles in the PM smaller than 100 nm. The highest enhancement is 207.8% at the diameter of 76.4 nm where the removal efficiency enhances from 27.1% to 83.6% and the highest removal efficiency is 90.6% at the diameter of 33.4 nm. What is more, the pressure drop of the filter does not increase and there is no ozone produced.

Dry/wet adhesive materials for wound care inspired by octopus suckers

Everyday challenges in medical and surgical practice involve stopping bleeding, closing wounds, and repairing organs, for which various hemostatic agents, sealants, and adhesives are used. Usually, these chemical closure materials, which need to be biocompatible, biodegradable, stable, and meet regulatory requirements, work as glues which bind tissues together to progress the natural healing. Nanotechnology research already has begun on this issue, resulting for instance in a method that employs gluing by aqueous nanoparticle solutions to effectively control bleeding and repair tissues. Another nanotechnology sealant that allows scar-free surgery is based on a biodegradable thin film of only about 20 nanometers thickness that could replace surgical stitches. A group of researchers in Taiwan demonstrates an uncomplicated and scalable templating technology for fabricating non-close-packed nanosuckers on PDMS substrates which exhibit great adhesive capacities on both dry surfaces and wet surfaces. In addition, resulting from the good flexibility of the PDMS, the nanosuckers can be deformed and generate an adhesion force on microrough surfaces. The technology is compatible with standard industrial manufacturing and provides a platform for varieties of medical applications ranging from hemostasis, wound care, and wound nursing. For instance, octopus arms, consisting of non-close-packed centimeter-scale suckers, can attach to objects in order to anchor the octopus body. The adhesion is generated by the suckers attaching to a target, forming a seal at the rim, and then inducing a negative pressure in the acetabulum regardless of the target surface materials. Inspired by these octopus arms, the researchers developed a nanosucker array using a scalable spin-coating technology, which enables large-scale fabrication of non-close-packed colloidal crystals. The team realized this bottom-up self-assembly methodology by shear-aligning concentrated silica colloidal suspensions with 20% silica particle fraction.

Large portfolio of 2D semiconductor materials benefits next-generation flexible electronics



Inspired by the unique optical and electronic property of graphene, two-dimensional (2D) layered materials, as well as their hybrids, have been intensively investigated in recent years, driven by their potential applications for nanoelectronics. The broad spectrum of atomic layered crystals includes transition metal dichalcogenides (TMDs), semiconducting dichalcogenides, monoatomic buckled crystals, such as black phosphorous (BP or phosphorene), and diatomic hexagonal boron nitride (h-BN), etc. This class of materials can be obtained by exfoliation of bulk materials to small scales, or by epitaxial growth and chemical vapor deposition (CVD) for large areas. Such atomically thin, single- or few-layer crystals are featured with strong intralayer covalent bonding and weak interlayer van der Waals bonding, resulting in superior electrical, optical and mechanical properties. They form a complete set of conductors, semiconductors and insulators that are transparent and mechanically compliant on flexible polymer substrates, making them attractive and promising for next generation flexible electronics. Recently researchers examined the recent advancement of flexible 2D electronic devices based on TMDs and BP. Researchers discussed the mechanical properties and strain-tunability of typical 2D semiconductors first, followed by novel growth and fabrication techniques that are compatible for 2D flexible devices. Subsequently, presented detailed application examples of field-effect transistors, photodetectors, strain and chemical sensors, and supercapacitors, with a final discussion of potential approaches and challenges to achieve 2D stretchable devices. The device applications covered in detail are flexible transistors; flexible optoelectronics; flexible sensors; and flexible supercapacitors. Flexible 2D devices that can undertake bending and mild straining deformations have been a fundamental step in realizing high performance, low-cost, transparent, and wearable electronics.

NANO PRODUCTS

OxyEnergy Power Cleaner

This is the product of Nigrin company from Germany. NIGRIN OxyEnergy Power Cleaner removes any dirt with the help of Active Power Oxygen. The oxidation process begins after it penetrates into the dirt and powerfully loosens particles of dirt from the surface. Areas of use: glass, textiles, plastic, paintwork and metal.

CARAVAN

Caravan is the product of the TCnano company from Denmark. Multi-functional care product for all lacquered and metallic surfaces with easy to clean properties. Future cleaning of the caravan becomes much easier and it is protected against weather impact. The product uses some of the nano materials for the enhancement of the properties of the product. The nano materials such as silver, silicon, silicon dioxide nano particles are suspended in a liquid medium. The product is used as surface coating, which can be coated on any metal substrate.

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