NEWSLETTER

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NANO PRODUCTS

Nano TiO2 PCO Liquid

The product is from the company Ionic Zone, USA. The active ingredient in Ionic Zone's Nano TiO2 PCO Liquid is crystallized nano sized Titanium Dioxide, a photocatalyst which in the presence of UV light creates friendly oxidizers in the air that eliminate odors, kills bacteria, and decompose VOC's. When pollutants come in contact with treated surfaces, they become oxidized as well. This revolutionary product is now gaining growing attention around the world, particularly in Europe and Asia as an effective, safe, antibacterial agent, deodorant, and indoor air quality solution.

EC70 Carbon Seat Post

This is a product of company Easton® Sports, Inc., Bicycle Products Group from USA. The new EC70 seat post now features Easton's Carbon Nanotube (CNT) infused Enhanced Resin System (ERS™) which offers improved strength and toughness of up to 20%. Now with less offset (10mm vs. 25mm) and a forged aluminum 2-bolt micro-adjustable head design for the perfect setup.

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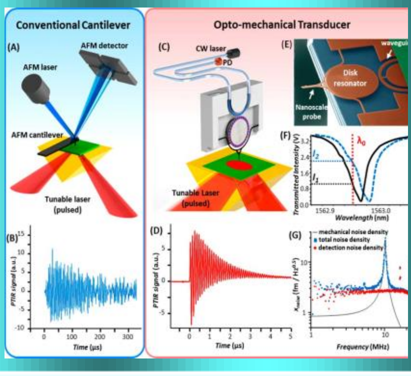
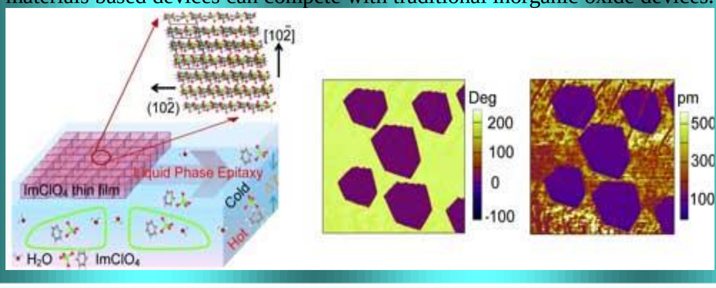
Nanophotonic AFM probe provides ultrafast and ultralow noise detection

Photothermal induced resonance (PTIR) has found application in the characterization of materials in fields spanning from photovoltaics, plasmonic, polymer science, biology and geology to name a few. PTIR combines the spatial resolution of atomic force microscopy (AFM) with the specificity of absorption spectroscopy, enabling mapping of composition and electronic bandgap, material identification and biomolecule conformational analysis with nanoscale spatial resolution. For instance, PTIR can provide information on a solar cell's composition and defects with nanoscale precision by measuring how much light the sample absorbs over a broad range of wavelengths, from visible light to the mid-infrared. PTIR signal transduction relies on the thermal expansion of the sample, which is in general a small quantity, especially for very thin samples. Furthermore, PTIR is a relatively slow technique. Researchers have now implemented, for the first time, an integrated near-field cavity-optomechanics readout concept to realize fully functional nanoscale AFM probes capable of ultralow detection noise (~3 fm•Hz-0.5) within an extremely wide measurement bandwidth (>25 MHz) in ambient conditions, surpassing all previous AFM probes. The sensitive transducers used in this work allow measuring samples as thin as a molecular monolayer with high signal to noise ratio and improve the measurement throughput. From this study, it was clear that a new approach capable of overcoming the trade-off between measurement sensitivity and time resolution was necessary. The transducers resulting from this new work break the trade-off between AFM measurement precision and ability to capture transient events. For PTIR, this capability improves the time resolution, signal-to-noise ratio and throughput by a few orders of magnitude each. As first practical application the scientists leveraged these characteristics to measure the intrinsic thermal conductivity of metal-organic framework (MOF) individual microcrystals, a property not measurable by conventional techniques. MOFs are a class of nanoporous materials promising for catalysis, gas storage, sensing and thermoelectric applications where accurate knowledge of thermal conductivity is critically important. Furthermore, the high signal to noise ratio could be leveraged to study defects in semiconductors. Going forward, the research team is interested in improving the measurement time-resolution further, possibly a few orders of magnitude; they caution, though, that such challenge will require additional breakthroughs in fabrication and measurements.



Advancing molecular ferroelectric thin-film technologies

An international research team now presents the first report on the preparation of high-quality large area MOFE films using in-plane liquid phase (IP-LP) growth. With this approach, different kinds of novel ferroelectric films can be grown for potential practical applications such as temperature sensing, data storage, actuation, energy harvesting and storage. This generally applicable approach allows precise control of film thickness, roughness, and homogeneity and crystal orientation by the solute concentration and growth environment, thereby enabling further studies to achieve orientation-controlled polarization and customizable ferroelectric properties for memory elements and sensors. The team have developed a water-based air-processable technique to prepare large-area MOFE thin films and devices, controlled by supersaturation growth at the liquid-air interface under a temperature gradient and external water partial pressure. Owning to its high spontaneous polarization, piezoelectric performance and high Curie temperature (~ 373 K) in the transparent ImClO4 thin-film, it shows remarkable novel electro-mechanical response, tunable electro-resistance and linear electro-optic effect. The team claimed that this method of preparing MOFE thin-film is universal. Therefore, it can be used for preparing numerous kinds of molecular ferroelectric thin-films with high quality for temperature sensing, data storage, mechanical actuation, actuation, energy harvesting, energy storage, etc. Going forward, the team will continue work on ImClO4 MOFE thin film based devices to further improve the performance of data storage and energy transduction properties. In a next step, they will try to use this universal method to fabricate some other kinds of novel MOFE thin-film devices to extend the application area and improve the performance. Molecular ferroelectrics should be air-stable, moisture-stable and non-corrosive for device applications – novel molecular ferroelectric materials should be explored to address the issues and researchers expect that someday the performance of molecular ferroelectric materials based devices can compete with traditional inorganic oxide devices.



Real-time monitoring of insulin with a nanotechnology sensor

Insulin is a rather small molecule (molecular weight 5.8 kD) and weakly charged in solution (isoelectric point 5.8) and therefore, low concentrations (<1 µM) are difficult to detect using traditional methods. Current insulin detection methods are time-consuming with a low sensitivity, and are hence not adequate for rapid and direct detection of insulin at clinically appropriate concentrations. The correct and timely use of insulin is strongly dependent on accurate predictions of insulin concentrations. However, the insulin concentration in the human body is time-varying. Thus, an inline insulin detection platform is highly desirable. Conventional electrochemical and optical platforms typically operate in an off-line manner. In contrast, a novel graphene nanotechnology sensor is highly sensitive to changes in the charge distribution on and in the immediate vicinity of the graphene surface and can respond to physiological insulin concentration variations in a sensitive and rapid manner, thereby enabling real-time insulin monitoring. This graphene aptameric nanosensor, revealed in a new study, will potentially allow real-time, highly sensitive and label-free monitoring of insulin. In this work, researchers employed an aptamer-based graphene field-effect transistor (GFET) nanosensor for insulin detection. The GFET can rapidly respond to external stimuli such as the binding between surface-immobilized aptamer molecules with insulin, resulting in significant changes of the electrostatic charge characteristics in the close proximity of graphene surface. This nanotechnology approach could be used in glucose-stimulated insulin release assays and holds the potential for timely and accurate prediction of insulin doses for the care of patients with Type I diabetes. The nanosensor developed in this study potentially provides a platform to exploit G-quadruplex conformation-switching signaling as the principle in a graphene electronic nanodevice to enable real-time monitoring of insulin at physiologically relevant concentrations – down to approximately 35 pM.