A WEEKLY INFORMATION LETTER 6TH JUNE 2017

NEWSLETTER

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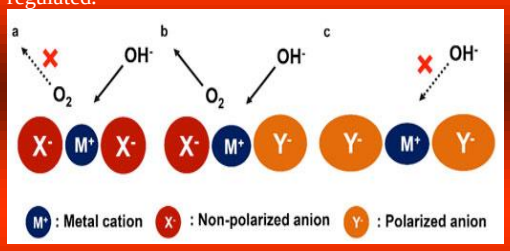
ADVANCEMENTS IN NANO TECHNOLOGY

Electrochemical energy storage with porous one-dimensional (1D) nanomaterials

The development of porous one-dimensional (1D) nanomaterials with designed properties and architectures has led to significant advances in electrochemical energy storage. In a recent work the state-of-the-art on porous 1D nanostructures, from methodologies for rational and controllable synthesis to their successful application in different types of energy storage devices is highlighted. They suggest that porous 1D nanostructures will overcome the limitations of many electrode materials, so that high capacity, fast charge and discharge, and long cycle life can be realized. In alkali ion batteries (LIBs and SIBs), porous 1D nanostructures with much shorter bi-continuous ion and electron transport pathways benefit high rate applications. Concurrently, the development of a robust porous structure offers the advantages of accommodating large volume changes which prevent structure collapse and improve cycle life. Outstanding electrochemical performance has been reported using a variety of different porous 1D nanomaterials as they can overcome certain limitations: (1) the poor ionic and electronic conductivity of electrode materials; (2) the interfacial impedance between electrode and electrolyte which arise from SEI layers forming on the interface of active materials; and (3) low volumetric energy density. The rational design of porosity and architecture leads to materials with properties that enable fast ion diffusion and rapid electron transport, reduce the exposure of active materials to the electrolyte and use assembly methods to increase volumetric energy density. Advanced lithium batteries (Li-S and Li-O2 systems) that offer higher energy density than LIBs can also benefit from using porous 1D nanostructures. Through nanocasting, sulfur can be embedded in porous nanofibers, establish strong adsorption properties and thereby inhibit the "shuttle effect" in polysulfide systems. The electrochemical performance of supercapacitors that store charge by double layer or redox processes has been improved by using porous 1D nanostructures. Constructing electrodes with porous 1D nanostructures that enable bi-continuous transport of electrons and ions will be beneficial for fabricating high energy density hybrid supercapacitors whose cathodes and anodes effectively combine the advantages of pseudocapacitive materials, especially for intercalation pseudocapacitance.

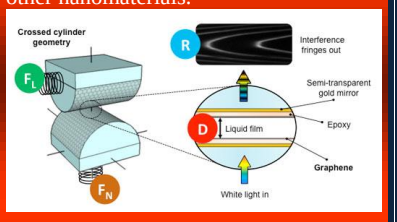
Anionic regulated electrocatalysts for water oxidation

The exhaustion of traditional fossil fuels and the growing demand for energy encourage us to develop sustainable and clean energy systems, such as fuel cells, rechargeable metal–air batteries, and water splitting devices. Oxygen evolution reaction (OER) constitutes the core process but severely limits the efficiency of the above energy devices due to its sluggish kinetics, calling for new insights into rational OER electrocatalysts design. Improving the intrinsic reactivity of OER active sites has always been pursued, and the electronic structure of the active sites directly determines the OER performance. Cationic doping and etching are typical strategies to approach optimized electronic structures. Researchers believe anionic regulation is another promising route to tune the electronic structure. Metal cations constitute the actual active sites of OER reaction, while the adjacent anions regulate the electronic structure of the active sites. Coupling nonpolarized anions with polarized anions is an innovative and effective strategy to tune the electronic structure and improving OER reactivity. This idea is coincidentally consistent with a Chinese traditional philosophy, 'coupling hardness and softness', where the nonpolarized anions are hard while the polarized anions are soft. Anionic regulation gives a new insight into rational OER electrocatalysts design and may also work in other catalysts system. Nickel and iron cations are considered as effective OER active sites in many cases. Meanwhile, oxygen anions are usually hard and nonpolarized while sulfur anions form the same group of the periodic table are soft and tend to be polarized in ionic compounds. XPS spectra of Ni 2p demonstrate obvious shifting to lower binding energy, suggesting lower oxidative state by receiving more electrons under anionic regulation, which means the electronic structure was effectively regulated.



How to directly measure the surface energy of pure graphene

In the past decade, graphene has received significant scientific interest as a new material and its potential to impact a wide range of technologies. Huge efforts have gone into studying its synthesis, fundamental properties, and the development of potential applications – and some applications based on bulk graphene are slowly entering the market. Surface energy is defined as the energy cost to increase a materials' surface per unit area. Therefore it indicates how likely molecules are to adsorb (/desorb) onto the surface or how strong it forms (non-covalent) bonds with other materials. Access to accurate surface energy values of graphene is thus not only of fundamental interest, but provides a useful reference for anyone involved in research on graphene properties, (surface) modifications, and the implementation of graphene in devices. New research by scientists in the UK demonstrates the successful application of the graphene surface force balance (g-SFB), which they developed earlier. Whilst a limited number of studies have reported surface energies for graphene already, all previous studies relied only on estimates based on indirect measurements, for instance, by pushing down a graphene beam onto an underlying graphite substrate, studying the intercalation of noble gas atoms between the graphene and a graphite substrate, contact angle, or gas chromatography measurements. The drawback of these approaches is that the measurements may be influenced by the adsorption of airborne contaminants and, in case of contact angle measurements, both the method of measurement as such and the underlying substrate. The work is of fundamental interest to a broad community and will aid the advancement of fundamental measurements of 2D and other nanomaterials.



NANO PRODUCTS

+ CerMet Nano-Particle Ceramic Conditioner

This is a product of CerMet company from USA. CerMet is a friction reducing, fuel saving ceramic-\metal conditioner that can be applied to any working mechanism without disassembly. It is not an oil additive and does not change oil properties in any way. It merely uses oil as a conduit for delivering ceramic-metal nano particle to friction zones. CerMet provides a unique application that will restore parts to like-new conditions while coating them with a harder and smoother ceramic-metal surface. CerMet continues to produce significantly positive results for passenger vehicles as well as for major fleets. CerMet is simple to use and has a money back guarantee. Now individual consumers can take advantage of this breakthrough fuel saving technology.

Dry Waterless Wash

The product is from Eurochem company, UK. Dry waterless wash, is a new biodegradable nanotech car cleaning product, that allows the user to wash their car without the need for water. The product is used as automotive accessory, used to clean automotives without the usage of water.