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NEWSLETTER

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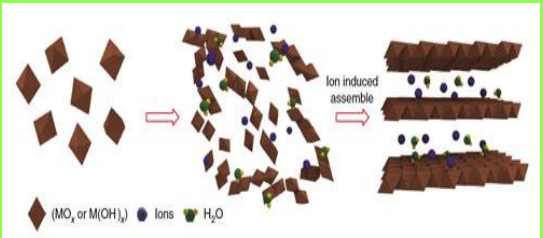
ADVANCEMENTS IN NANO TECHNOLOGY

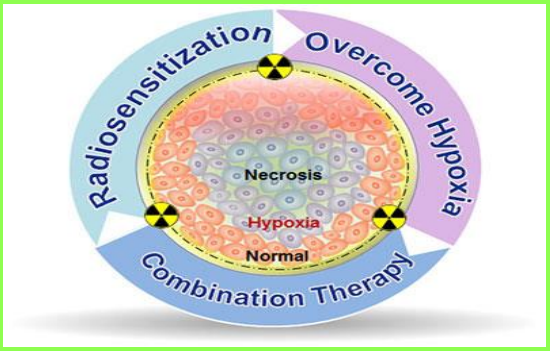
Synthesis of 2D metal oxides and hydroxides - high-yield, efficient, fast and low-cost

As two-dimensional (2D) materials gain more and more importance – thanks to their exotic electronic properties and abundant active sites – the development of high-yield, efficient, fast and low-cost synthesis methods to advance these materials from the laboratory to industry has become an urgent issue. Previous research has shown that ions always play a key role in the synthesis of 2D materials. However, it should be noted that when the synthesis process occurs in solution, desolvation is a necessary step because ions are in the solvated state in solution. Unfortunately, though, the energy consumption for desolvation increases the overall activation energy, thus limiting the reaction rate. In new work, a team developed a general and rapid molten salts method (MSM) – widely studied for the synthesis of nanomaterials, such as graphene and perovskite – that can synthesize various ion-intercalated 2D metal oxides and hydroxides, such as cation-intercalated manganese oxides, cation-intercalated tungsten oxides, and anion-intercalated metal hydroxides. The most significant result of this work is the ability to obtain high quality 2D materials within just 1 minute by using very cheap and common source materials. This is a big step towards the commercialization of 2D materials. The key feature of our method is the direct use of naked ionized ions without hydration in the molten state salt to quickly induce the growth of 2D metal oxides and hydroxides. In this technique, by adding precursors into the low-cost molten salts for only 1 minute, we could obtain high-yield 2D materials simply by washing the salts. Even without centrifugation or sedimentation, we do not observe particles or nanowires in the final products.



Enhancing radiation therapy with nanotechnology

In an effort to devise novel and more effective anticancer regimes, a rapidly growing community of researchers is applying the unique properties of nanomaterials to combat the unmet challenges posed by classical radiation therapy (RT) – which has become one of the most effective and frequently applied cancer therapies. The high surface area, stability, and facile tunability of nanomaterials make them ideal for transportation of chemotherapeutics, phototherapeutic agents, radiosensitizers, oxygen reservoirs, etc. across several physiological barriers.



A major advantage of RT lies in its noninvasive nature, which leads to less physiological and psychological burden being placed on the patients. In a recent Perspectives article researcher take a brief look at the emerging roles of nanotechnology in the rapidly evolving domain of modern/future radiation therapy.First, there is a pressing need for rationally designed nanoformulations that exhibit optimal tumor-homing and intratumor distribution. Improved tumor penetration by such nanoformulations can enhance RT outcomes, especially when combined with hypoxia-responsive therapies. Second, a paucity of data on the long-term in vivo behavior and toxicity profiles of nanoparticles has severely impeded the transition of even well-established nanoformulations from preclinical to clinical settings. Third, nanotechnology provides a promising platform to bridge the gap between the newly emerging targeted therapies and traditional RT.

NANO PRODUCTS

Nanodeck® Car paint

This product is from the company Nanodeck, Germany. The paint is protected from dirt and other environmental influences in an optimal and lasting way. Even insects, resin, tar, bird's dirt and windfalls can easily – without additional cleanser – be removed just with water. No more additional waxing or other paint cleanser required.

IOGEAR® Personal Security Mouse with Nano Technology

The product is from the company IOGEAR®, Inc., USA. IOGEAR's Personal Security Mouse is coated with a Titanium Dioxide (TiO2) and Silver (Ag) nano-particle compound. The coating uses two mechanisms to deactivate enzymes and proteins to prevent a wide spectrum of bacteria, fungi, and algae from surviving on the surface of the mouse. The compound has been tested and proven effective against the settlement of harmful microbes on the insulated surface.

Dendrimer nanomedicine - developing efficient therapeutic strategies for the treatment of neurological disorders

A dendrimer is a polymeric nanostructure built around a core unit. There are several branching units around the core units in a layer-by-layer fashion which defines the growth, size, and the microenvironment within the dendrimer.Dendrimers are composed of a large number of smaller units known as dendrons. Dendrons are formed after removal of core units and can be divided into (empty) core, the interior (branching units), and the periphery (end groups). The empty space lying inside the dendrons can be used for the entrapment of drug molecules for solubilization, controlled release, targeting, or protection from surrounding degrading environment. These nanostructures have emerged as a powerful class of nanomaterials in nanomedicine due to their unique structural features: globular, well-defined, highly branched and controllable nanostructures where the presence of several terminal groups can be functionalized with different ligands simulating the multivalency present in different biological systems. A recent review article in *Advanced Functional Materials* by scientists in Portugal identifies the currently existing dendritic systems and discusses their strengths and caveats in the context of attaining efficient therapeutic strategies for the treatment of neurological disorders. Besides the diagnosis and/or *in vitro* dendrimer-based products already in the market, dendritic systems have already reached the clinical evaluation as contrast-enhancer magnetic resonance imaging agents (Gadomer®-17), anti-microbicides (Vivagel®), and drug carriers for solid tumors therapy (DEP™ docetaxel).Notwithstanding, despite all these documented applications, the use of dendrimers within the central nervous system (CNS) is still in its infancy and there are no reports of marketed products or current clinical trials using dendrimers for CNS diseases therapy.One of the most significant challenges in CNS disease therapy is the ability of therapeutic bioactives to permeate the blood-brain barrier (BBB) and reach CNS in an adequate bioavailability.