Commentary

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The Generation of the Corresponding Nanorods in the Molten Salt with a High K+ Content

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Description

C-Responsive Protein (CRP) is a plasma protein that is perhaps of the most communicated protein in intense stage irritation cases. It is a well-known biomarker for diseases caused by inflammation. An increase in CRP concentration is strongly correlated with an increased risk of sepsis and cardiovascular disease; As a result, clinical diagnostics can be improved and major inflammatory conditions can be prevented by monitoring and quantifying CRP levels in a simple, inexpensive, and quick manner. A nanobiosensor that uses the gold-nanorod LSPR property to measure CRP concentration was developed here. One-pot synthesis with the surfactant trimethyl ammonium bromide was used to create nanorods. Nanorods as products are less likely to be contaminated thanks to this approach, which also reduces synthesis steps and time. TEM analysis revealed that the nanorods had an average aspect ratio of 4.9 and a size of (241 nm) (51 nm).The LSPR shifts as a result of the gold nanorod's refractive index change as a result of protein interaction with the biosensor investigated using a 100–900 nm UV absorption device. The surface of the rods was modified with a specific aptamer for the target protein. The nanobiosensor could respond to various CRP concentrations within 30 minutes, according to the findings. The selectivity test revealed that the nanobiosensor did not respond to the BSA and TNF- proteins, which are used to evaluate the behavior of biosensors in non-target proteins.

One-Dimensional Nanomaterials

This work used Molten Salt Synthesis (MSS) with $Ba(NO_3)_2$ and anatase TiO_2 as reactants to produce high-yield $BaTi_2O_5$ (BT2) nanorods with a growth direction of [020]. The detection limit was set at 2 nM, and the linear response of the sensor was between 2 and 20 nM. After 45 minutes of heating at 950°C, ultra-pure BT_2 nanorods of uniform size were produced by adjusting the involved reaction factors, such as particle sizes, thermal holding durations, and crystalline TiO_2 forms, to their highest possible levels. In the meantime, rutile TiO_2 and anatase were mixed together and calcined in KCl to investigate the formation and transformation of BT2 nanorods in detail. It was discovered that anatase TiO_2 tends to coalesce into rutile TiO_2. Particularly, without the presence of rod-like templates, the formed rutile TiO_2 spontaneously reacts with BaO and $BaTiO_3$ to form BT_2 nanorods. In addition, the generation of the corresponding nanorods in the molten salt with a high K+ content favors BT_2 over $K_2Ti_6O_{13}$. Additionally, the formation of nanorods is aided by the oxygen in the air. The proposed mechanism for the initial formation, growth, and transformation of BT_2 nanorods was supported by the experimental findings, making it easier to prepare one-dimensional nanomaterials based on BT_2. In situ growth of ZnO nanorods as a sensing electrode on Yttria-Stabilized Zirconia (YSZ) electrolyte was used to create a planar mixed-potential sensor in this study. The sensor's potentiometric sensing properties toward 2-ethyl hexanol (2-EH) and dioctyl phthalate (DOP), two early PVC cable fire signature gases, were investigated. For a ZnO nanorods-based sensor, response values of 205.1 mV and 54.1 mV were achieved at 400°C for 171–193 ppm 2-EH and 89–109 ppt DOP, respectively. These values were 1.7 and 4.1 times higher than those of a ZnO nanoparticles-based sensor. In addition, ZnO nanorods were significantly more selective for 2-EH and DOP. The distinctive three-dimensional electrode morphology may be responsible for the improvement in ZnO nanorods' gas-sensing performance.

Through annealing in a sulfur atmosphere and Chemical Bath Deposition (CBD), Bi_2S_3 nanorod films were grown on ITO-coated glass substrates. With a direct optical band gap of 1.87 eV and a particle size of 20 nm, the as-deposited films were amorphous/nanocrystalline. Upon annealing at 350 °C, the films developed a nanorod shape with a length of 300 nm. The nanorods' diameter increased when the temperature was increased from 400 to 450°C. By increasing the annealing temperature from 350 to 400 °C, the direct optical band gap shrank from 1.68 to 1.47 eV. Due to their nanorod structures, photoelectrochemical measurements revealed that the nanorod films grown on ITO-coated glass substrates exhibited significantly increased PEC activity. At 1 V, the maximum photocurrent density of the 400 °C-formed Bi_2S_3 nanorod films was 6.1 mA/cm^2, 2.5 times higher than that of the as-deposited films. The effective visible-light absorption of Bi_2S_3 nanorods as a result of their increased crystallinity and decreased band gap could account for the rise in the photocurrent density. For optimal PEC water-splitting applications, this study demonstrates a simple and inexpensive CBD method for the synthesis of Bi_2S_3 nanorod films. A simple chemical precipitate reaction was used to make one-dimensional -$ZnMoO_4$ nanorods with diameters ranging from 30 to 50 nm in this study. This method is suitable for scalable synthesis, is simple, saves energy, and does not require any special equipment. Transmission electron microscopy and quick Fourier change design show that the nanorods develop along the [011] gem plane. The as-synthesized-$ZnMoO_4$ nanorods deliver a high capacity of approximately 417.6 mAh g^{-1} after 800 cycles at a current density of 0.2 A g^{-1}, an excellent rate (140 mAh g^{-1} even at 2.0 A g^{-1}), and a fast lithium-ion diffusion coefficient that is superior to the bulk counter and the one that was previously reported (2.29 1017 cm^2 s^{-1}).

Multifunctional Nanostructures

The advantageous nanorods feature is probably to blame for the remarkable electrochemical performance. Surface-Enhanced Raman Spectroscopy (SERS) has found widespread use in the analysis of biomolecules, explosives, and environmental pollutants at low concentrations. Photo Induced Enhanced Raman Scattering (PIERS), in which samples are excited by appropriate light prior to or during Raman measurement, has emerged as a novel strategy to further, enhance the sensitivity of SERS measurements. In this review, we effectively manufactured SERS substrates with great awareness in view of ZnO/Au nanorods by effortless galvanic helped aqueous and faltering procedures. In comparison to conventional SERS measurement, in situ UV-excitation can further enhance Raman signal in a convenient and effective manner. For low-concentration substances, this approach offers a fast, reliable method. These days, metal contamination because of the colossal arrival of harmful components to the climate has become one of the world's most concerning issues. Bioremediation is an effective, environmentally friendly, and cost-effective strategy for reducing the mobility and toxicity of these contaminants (such as selenium).The ability of Stenotrophomonas bentonitica to biotransform SeVI through enzymatic reduction and volatilization is described in this study. The bacterium was able to effectively reduce SeVI (200 mM) into intra- and extracellular crystalline Se0 nanorods, primarily composed of two distinct Se allotropes, according to HAADF-STEM analysis. trigonal (t-Se) and monoclinic (m-Se)A process of Se crystallization based on the biotransformation of amorphous Se0 into stable t-Se nanorods appears to be suggested by XAS analysis. In addition, the formation of methylated volatile Se species like DMSe (dimethyl selenide), DMDSe (dimethyl diselenide), and DMSeS (dimethyl selenenyl sulfide) was revealed by headspace analysis using gas chromatography-mass spectrometry (GC–MS).The biotransformation pathways and tolerance reported for this bacterium in the presence of SeIV are significantly different. Through the production of Se with lower toxicity and higher settleability, which has potential industrial applications, the formation of crystalline Se0 nanorods could have beneficial effects on the environment (such as bioremediation). Synthesis and fabrication of multifunctional nanostructures with enhanced biocompatibility and excellent antibacterial applications for preventing implant failure after surgery dominate biomedical research. The purpose of this study is to determine the ideal mesoporous zinc-doped hydroxyapatite (HAp) for use in biomedical research in the future.

Utilizing biowaste Nodipecten nodosus scallop as a calcium source and CTAB as an organic modifier, we synthesized mesoporous Zn-doped HAp nanorods with varying mole concentrations through a profound microwave hydrothermal method in this study. The microwave hydrothermal method is used to transform biowaste Nodipecten nodosus scallop, a readily available and inexpensive calcium precursor, into pure, zinc-doped hydroxyapatite nanorods. The structural and morphological characteristics of synthesized pure and mesoporous Zn-doped HAp nanorods were evaluated and precisely characterized using a variety of analytical methods, including spectroscopy and electron microscopy. Mesoporous Zn-doped hydroxyapatite nanorods of various sizes and morphologies can be successfully produced using CTAB and microwave hydrothermal techniques. Compared to other nanorods, Mesoporous Zinc-doped HAp nanorods exhibit superior antibacterial activity against Klebsiella pneumoniae (MTCC 7407) and Bacillus subtilis (MTCC 1133). ZnHAp-3 has a zone of inhibition of 12.36, 0.12 and 13.12, 0.16 mm, respectively, that is highly effective against B. subtilis and K. pneumoniae. Additionally, ZnHAp-1 exhibits the lowest inhibition zone, whereas ZnHAp-3 exhibits the highest inhibition zone. Toxicity assays to confirm the safety of mesoporous zinc-doped HAp intensified with the zebrafish model's proliferation function were the primary study's focus. The outcomes uncover the non-harmful way of behaving of unadulterated and mesoporous zinc-doped HAp tests. As a result, our research provides evidence that a novel CTAB-enabled microwave hydrothermal method utilizing biowaste Nodipecten nodosus scallop as a calcium source for the synthesis of mesoporous zinc-doped HAp nanorods will be an alternative affordable biocidal antibacterial material for controlling implant failures following surgery.