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Editorial

Plasmonic Nanomaterials for Optical Sensor and Energy Storage and Transfer

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Nanomaterials including noble metal nanomaterials and some metal oxide nanomaterials exhibit very strong light-matter interactions under resonant excitation. Very large absorption and scattering at the localized wavelengths can been achieved. Because of their attractive optical properties, optical NPs and nanostructures have been commonly used in various fields from nanophotonics, analytical chemistry, biotechnology, and information storage to energy applications including photovoltaics and photocatalysis [1, 2].

Here, five original research articles seek to address the new preparation of optical nanomaterials, interesting design of optical sensor, and energy storage. Moreover, the new physical phenomena and mechanisms in these fields are discussed.

Dr. S. R. Tahhan and coworkers reported the fabrication of fiber Bragg grating coating with TiO_2 nanostructured metal oxide for refractive index sensor. Higher shifts and narrower peaks in the Bragg wavelength were obtained after coating the fiber with few hundreds nanometers thick TiO_2 coating of 20 nm–50 nm hole diameters. The sensitivity of the sensor with the TiO_2 coating is higher than that without coating due to the nanostructure's large surface area.

The mode structures of multiphoton induced ultraviolet laser in a ZnO microrod have been investigated by Dr. G. Zhu. Hexagonal wurtzite structural ZnO microrods were fabricated by vapor-phase transport method. Under the excitation of a pulse laser with 1200 nm wavelength, the multiphoton induced ultraviolet (UV) laser was observed in a microrod. The dependence of the laser mode structures on pump intensity was investigated. The result indicates that the laser belongs to whispering gallery mode (WGM) at low pump intensity and Fabry-Perot (FP) mode at high pump intensity.

Another work around controllable growth of the ZnO nanorod arrays has been reported by Dr. Q. Liu and coworkers. High quality ZnO nanorod arrays are formed using the ZnO nanoflakes on the Al substrates as seed layer. They found that a reversible wettability transition can be easily achieved via alternation of UV irradiation and dark storage. The physical adsorption of the water molecules on the surface of ZnO nanorod arrays is considered to be responsible for this transition, which is confirmed by X-ray photoelectron spectroscopy.

L. Cai and Dr. C. Feng have discussed the effect of vacancy defects on the electronic structure and optical properties of GaN using the generalized gradient approximation method within the density functional theory. The results show that the band gap increases in GaN with vacancy defects. Crystal parameters decrease in GaN with nitrogen vacancy (GaN:VN) and increase in GaN with gallium vacancy (GaN:VGa). The Ga vacancy introduces defect levels at the top of the valence band, and the defect levels are contributed by N2p electron states.

In addition, synthesis of xLiMnPO4·yLi3V2(PO4)3/C nanocomposites for lithium-ion batteries using tributyl phosphate as phosphor source has been reported by Dr. F. Wang and coworkers. They synthesized new xLiMnPO4·yLi3V2 (PO4)3/C nanocomposites, which is a very important issue for high-performance lithium-ion batteries.

The topic around optical properties of nanomaterials is very important and timely. They have been widely applied in plasmon-enhanced spectroscopy, photocatalysis, energy storage, and solar cells. This topic is of relevance to the general research in chemistry, physics, optics, and material science and will attract great attentions of researchers in these fields who are new to or experienced in the plasmon-enhanced application in wide fields. Therefore, the potential broad audience of this issue will further promote the development of plasmon-related researches and accelerate their practical applications in various fields including surface-enhanced spectroscopy, energy storage, and energy transfer.

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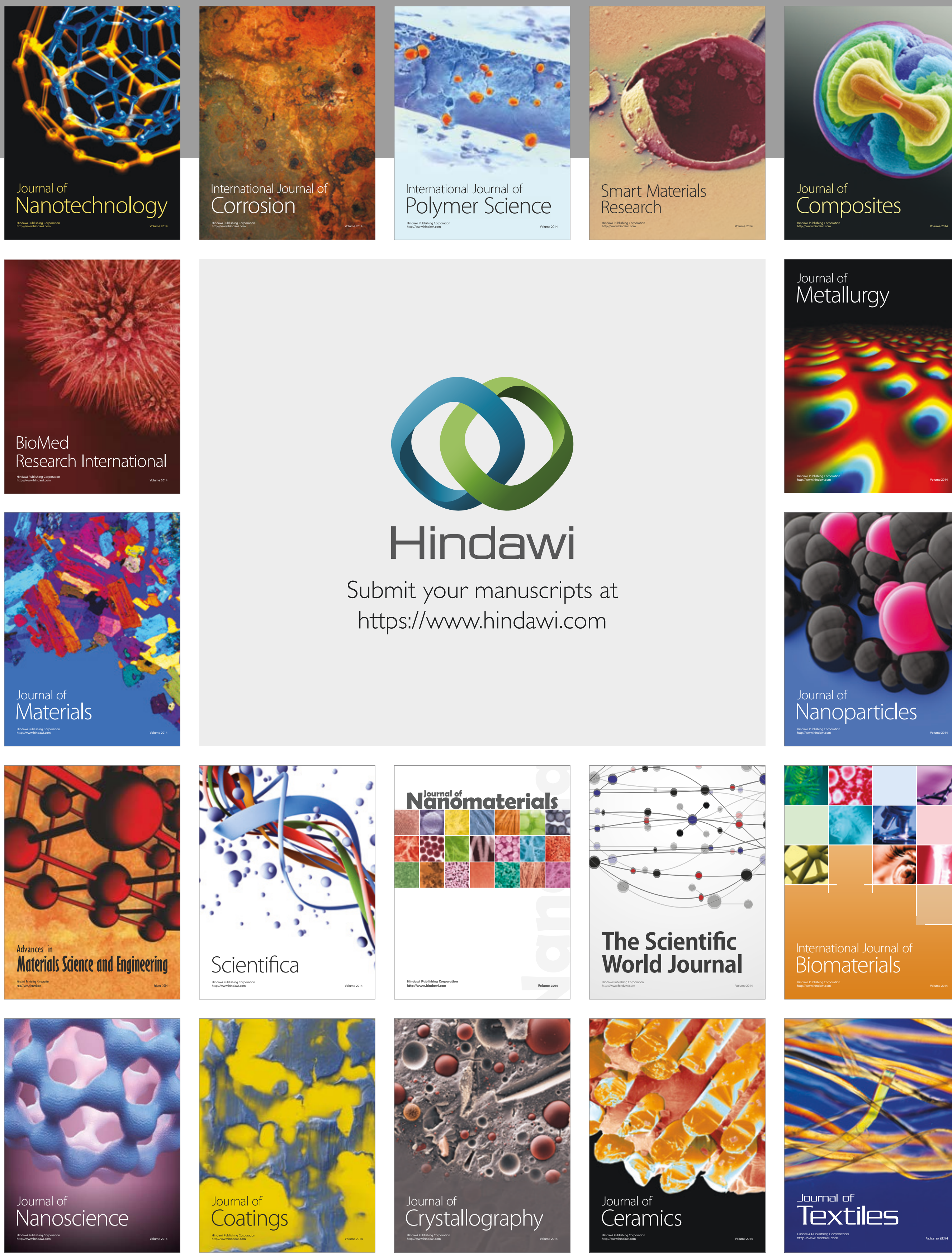
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