Hindawi Publishing Corporation
Journal of Nanomaterials
Volume 2015, Article ID 283286, 2 pages
http://dx.doi.org/10.1155/2015/283286

Editorial

Nanomaterials for Biomedical Applications and Environmental Monitoring

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Received 3 September 2015; Accepted 6 September 2015

In recent years, outbreak of emerging diseases and environmental pollution has been a significant threat on global economies and public health. Nanomaterials have high potential to address these challenges due to their advantages such as large surface area, outstanding properties, and high flexibility. In this special issue, several excellent research results on advanced nanomaterials for biomedical applications and environmental monitoring were reported.

As first challenge for biomedical applications, J.-S. Lee et al. developed a nanobiosensor to detect a lung cancer-specific biomarker. The nanobiosensor is based on an anodic aluminum oxide (AAO) chip and functions on the principles of localized surface plasmon resonance (LSPR) and interferometry. The sensor chip is sensitive to the refractive index (RI) changes of the surrounding medium and also provides simple and label-free detection when specific antibodies are immobilized on the gold-deposited surface of the AAO chip. The limit of detection (LOD) was found to be 100 ag/mL and the biosensor had high sensitivity over a wide concentration range. Q. Wang et al. evaluated the remineralizing efficacy of fluorohydroxyapatite (FHA) gel on artificial dentinal caries lesion in vitro. It was found that the FHA gel could rapidly construct apatite on the artificial dentinal caries surface and significantly increase the mineral density, which suggested that FHA gel might be a proper IPT material with remineralizing function. G. Raniszewski et al. reported the results of the investigation into the applications of carbon nanotubes with ferromagnetic nanoparticles as nanoheaters for targeted thermal ablation of cancer cells. Application of carbon nanotubes with ferromagnetic properties can be used in a radio frequency thermal ablation. RF ablation therapy brings the lowest risk compared to the other techniques (e.g., surgery and chemotherapy) of tumor therapy. This method offers faster and more targeted treatment for liver cancer with fewer side effects. W. Chigumira et al. presented preparation and evaluation of pralidoxime-loaded PLGA nanoparticles as potential carriers of the drug across the blood brain barrier. Y. Tian et al. reported the use of gold nanoparticles to increase PLK1-specific small interfering RNA transfection and induce apoptosis of drug-resistant breast cancer cells. The transfection of PLK1-specific siRNA into cells not only silenced its targeting genes but also induced apoptosis of the drug-resistant breast cancer cells. It was worth noting that exclusive gold nanoparticles (GNPs) had no toxic effect on normal/cancer cells. Importantly, the GNPs could be visualized by X-ray imaging in a concentration dependent manner because of the excellent properties of gold. Overall, this work disclosed the great potential of GNPs as the excellent delivery system in gene therapy for drug-resistant cancers and the further application of X-ray imaging.

As second challenge for environmental monitoring, S. Adhikari and D. Sarkar synthesized a mixed semiconductor of ZnO combined with WO_3. An optimum amount of 10 wt.% nanocuboid WO_3 addition to quasi-fibrous ZnO is an effective choice for methyl orange dye degradation compared to commercial ZnO nanoparticles. The prepared mixed oxide nanocomposite of WO_3 and ZnO is found as an effective photocatalyst for degradation of organic pollutants in water. Takei et al. reported on a thin layer chromatograph (TLC) with a built-in surface enhanced Raman scattering (SERS) layer for in situ identification of chemical species separated by TLC. The TLC-SERS plates with a built-in SERS layer consisting of cap-shaped noble metal nanoparticles could be used for environmental monitoring and food safety assurance. The authors prepared their TLC-SERS plate with the following procedure: (1) adsorption of 100 nm in diameter SiO_2 nanospheres as a dense monolayer on a glass slide, (2) evaporation of gold or silver with thicknesses up to 100 nm, and (3) spreading of chromatography silica gels. Interestingly, they demonstrate that the TLC-SERS can separate mixture samples and provide in situ SERS spectra. We prepared two types of samples. One was a mixture consisting of equal portions of Raman-active chemical species, rhodamine 6G (R6G), crystal violet (CV), and 1,2-Di-(4-pyridyl)ethylene (BPE). The other was skim milk with a trace amount of melamine. The three-component mixture could be separated into three components and their SERS spectra could be obtained individually and that melamine added to skim milk could be detected only after separation. Additionally, the use of hierarchically assembled porous ZnO microspheres with enhanced gas-sensing properties was reported by S. You et al. The sensitivity of porous ZnO to ethanol gases increased with the increasing of ethanol concentration.

By combining these excellent results, the special issue provides advanced progress in the development of functional nanomaterials for biomedical applications and environmental monitoring.

Acknowledgment

On this chance, we would like to thank all of the authors for their contributions to the special issue. Thanks are also due to this journal for giving us a chance to edit this special issue. We do hope that you can find useful information from this special issue for your future research works.

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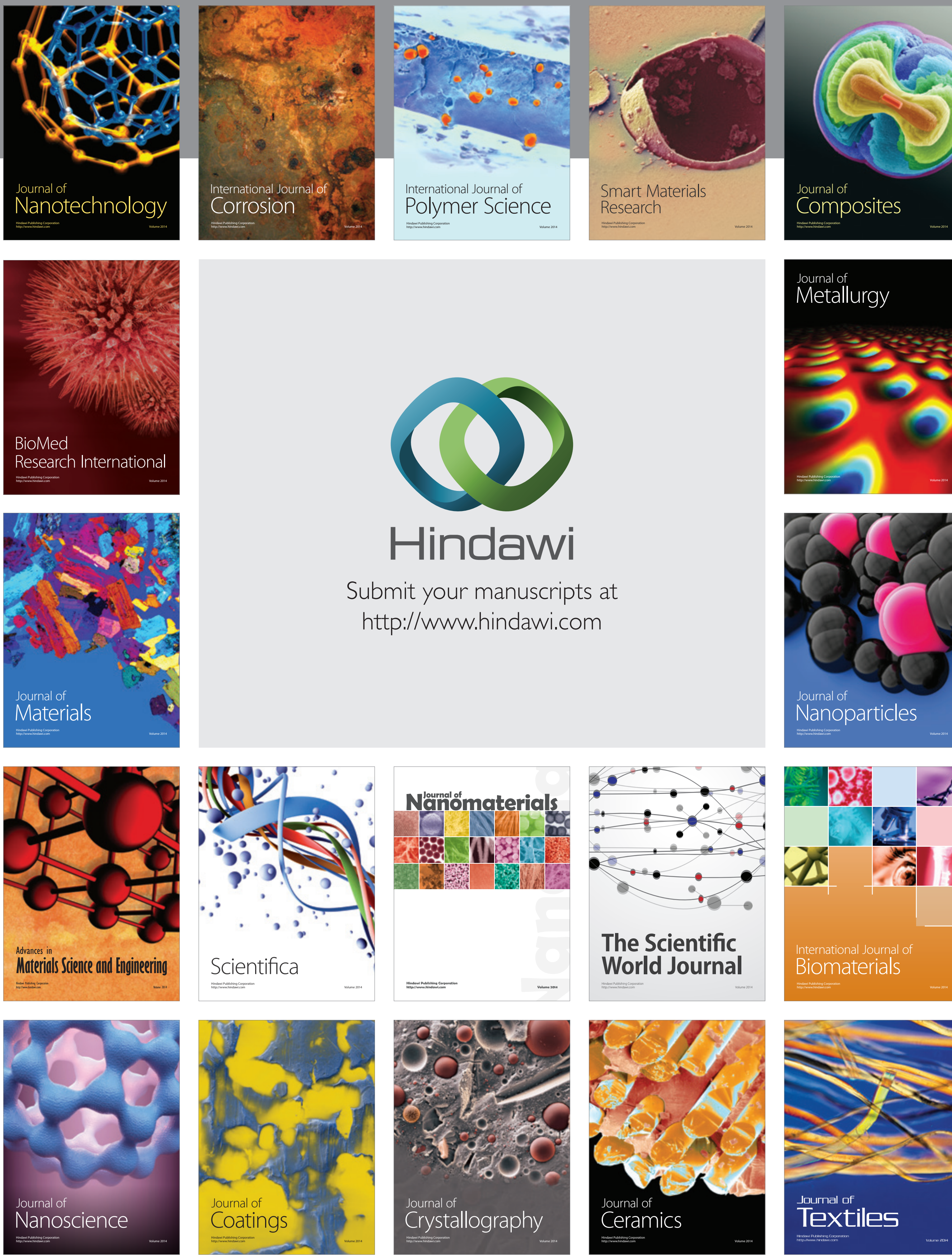
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