Editorial

Novel Synthesis and Applications of Metal, Metal Oxides (MOs), and Transition Metal Dichalcogenides (TMDs) for Energy, Sensing, and Memory Applications

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Study of metal, metal oxides (MOs), and transition metal dichalcogenides (TMDs) micro-/nanostructures has been an area of interest for researchers recently. These materials exhibit interesting properties for a wide range of applications ranging from electronics to energy conversion. Nanostructures and composites of these metallic nanomaterials due to their high aspect ratio and quantum confinement have been studied for many applications including energy conversion, bio/chemical sensing, and memory applications. Among the different synthesis techniques that are reported for these nanomaterials, physical and chemical methods are the two well-known synthesis routes. In this special issue, we present a selection of invited and contributed articles, which focus on both synthesis and application of these nanomaterials. These accepted manuscripts span a wide range of materials for the applications highlighting novel fabrication techniques as well as suitable test protocols.

In an article entitled “Deposition of Gold Nanoparticles via Galvanic Replacement in DMSO and Their Influence on Formation of Silicon Nanostructures,” M. Shepida et al. have reported a lithography-free gold nanoparticle (Au NP) deposition technique on Si substrates through galvanic replacement (GR) in dimethyl sulfoxide (DMSO) solution. The authors further analyzed the effect of HAuCl_4 solution concentration, reaction time, and temperature on the characteristics of the deposited Au NPs. By using the metal-assisted chemical etching method, they demonstrated one of the possible applications of synthesized Au NPs, e.g., the formation of nanorods. N. Odaira and Y. Arita in the article

entitled “An Estimation of the Thermal Properties of Pu-Rich Metallic Fuel” have studied and reported the estimation of thermal properties of a Pu-rich metallic fuel which has potential to reduce minor actinides with small capacity of fast reactors. Their estimation, using both Nordheim’s rule and Wiedemann–Franz law, indicated that this metallic fuel has much lower thermal conductivity and melting point. Furthermore, it was observed that the uranium addition causes increasing thermal conductivity and melting point. In the paper entitled “Synthesis of Mesoporous TiO_2 Spheres via the Solvothermal Process and Its Application in the Development of DSSC,” S. Velázquez-Martínez et al. have described both the preparation and testing procedure of TiO_2 microstructures. They have discussed the usefulness of the solvothermal method for making TiO_2 nanoparticles that can be used for solar energy conversion efficiently. For example, the effects of changing solvent-system on the TiO_2 products have been studied and reported in detail.

G. Fedorenko et al. in the paper entitled “Oxide Nanomaterials Based on SnO_2 for Semiconductor Hydrogen Sensors” reported a synthesis of SnO_2 nanostructures which were then characterized for hydrogen sensor applications. Atomically thin SnO_2 (~5.3 nm) was synthesized using the sol-gel method. Additionally, palladium doping was done in order to improve response to hydrogen, and a comparison was made with undoped SnO_2 . It was observed that doped nanostructures provide fast response and recovery time and a wide measuring range of hydrogen content in air ambient with good repeatability of the sensor signal. Such promising

properties could make useful sensors based on these nanomaterials for devices intended to determine hydrogen in air. In the paper entitled “Characterization of Layer Number of Two-Dimensional Transition Metal Diselenide Semiconducting Devices Using Si-Peak Analysis,” X. Zhang has reported a nondestructive method of characterizing the layer number of “atomically thin” stacking 2D transition metal diselenide nanomaterials, namely, MoSe₂ and WSe₂, using Raman spectroscopy. The Raman approach for finding the layer number of MoSe₂ and WSe₂ were reported to be controlled by the change in their optical properties while testing up to four layers.

Concluding the guest editors highlights, we believe that the articles published in *Advances in Materials Science and Engineering*, special issue, provide useful information as a basis for a better understanding of the metal, MOs, and TMDs micro-/nanostructures and may further aid the scope fabrication and use of multifunctional nanomaterials.

Conflicts of Interest

The editors declare that they have no conflicts of interest regarding the publication of this Special Issue.

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