

Editorial

1D Nanomaterials 2013

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The advent of nanotechnology, in its simplest form, through the words of R. Feynman inspired generations of scientists to keep pushing the boundaries of molecular assembly towards the atomic level. While the definition of nanotechnology has evolved over the years, the core principles are based on the control of molecular assemblies on the nanometre scale. Nanomaterials have become popular as a result of targeted funding for collaborative projects across scientific disciplines and the increase in public awareness. The consumer trend to make devices smaller and smarter has, in part, driven areas of research such as computing, with the modest overtones from Moore's Law to the realisation of microprocessors with nanoscale architectures. 1D nanostructures are essential to the development of new composites that will scale down and improve our understanding of materials and their properties on the nanoscale.

A total of 12 articles were selected for publication (50% acceptance) with a fairly even distribution of papers based on carbon nanotubes, nanoparticles, fibres, nanowires, and inorganic nanotubes. The most popular area of research was based on nanorods. Bi₂S₃, MgO, and ZnO all formed the basis of the nanorods, with gold coated carbon nitride being used by I. P. Jamal et al. as a template for silicon/carbon core-shell nanowires. The synthetic methods for the production of nanorods were further explored by A. Tahmasian et al. and Y. Jiao et al. using sonochemical synthesis and hydrothermal

synthesis to produce the inorganic nanorods. Controlling the conditions for the growth of ZnO nanorods has been a hot topic for the last few years with many pathways available to achieve the desired characteristics. If the study on the growth mechanisms of carbon nanotubes had the same research vigor, we may be able to expand the utility of the tubes in composites. Carbon nanotubes were used by Q. Zhou et al. to show how the thermal conductivity of armchair and zigzag CNTs increased when the radius of the tubes decreased, and Y. Show et al. demonstrated the formation of composite films of CNTs and polytetrafluoroethylene (PTFE) with the potential to be used as an anticorrosive film for proton exchange membrane fuel cells. Inorganic nanotubes were investigated by Y. Liu et al. with the synthesis of template-induced tin oxide nanotubes. This hydrothermal synthetic method produced 100 nm diameter tubes with lengths in the order of several micrometers. CNTs formed the basis of these tubes and further highlighted the utility of CNTs for templated assembly.

C₆₀ nanofibers were explored by B. Wang et al. with an emphasis on the conditions for growth. The nanofibers also known to most fullerene researchers as C₆₀ crystals are a familiar sight but not singled out for their properties as much as individual C₆₀ molecules and their derivatives.

The need for an alternative energy economy has gained more traction in recent years. Wind turbines and household

solar cells have become commonplace in urban areas. Photovoltaics currently show the most amount of potential from small consumer electronics, to large scale supplements, to conventional energy resources. While silicon based devices are still the preferred material in the production of solar cells, research has shown the potential for many systems such as dye sensitized solar cells and CdTe thin films. However, some of the highest cell efficiencies in recent years have come from multijunction devices. The photovoltaic properties of the oxide p-n heterojunction of Cu₂O/ZnO nanowires were examined by S. K. Baek et al. The photovoltaic structure showed a better conversion efficiency than planar Cu₂O/ZnO solar cells, and the increase in the short circuit current density was attributed to the improved long wavelength absorption, as a result of the increase in junctions.

Nanoparticles, which in the strictest terms conform to 0D structures, can form the “building blocks” for 1D nanomaterials. One example was demonstrated by J. Gao et al. where a 1D array of silver nanoparticles was produced for use as a surface-enhanced Raman scattering (SERS) substrate. The one-step synthesis of silica nano-/submicron spheres was examined by F. Gao et al. with a size distribution in the order of 600–800 nm, comprised of amorphous silica. Both of the papers on nanoparticles illustrate a level of control on the morphology of the units which may prove useful in the synthesis and characterisation of 1D structures.

These papers provide an insight into the synthesis and potential applications of various 1D nanostructures which would be of significant interest to researchers in the field.

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