Editorial

1D Nanomaterials 2011

Yanqiu Zhu,¹ Raymond L. D. Whitby,² Renzhi Ma,³ and Steve F. A. Acquah⁴

¹ College of Engineering, Mathematics and Physical Sciences, University of Exeter, Exeter EX4 4Qf, UK

² Nanoscience & Nanotechnology Group, University of Brighton, Faculty of Science & Engineering, Huxley Building, Brighton, BN2 4GJ, UK

³ International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science, Tsukuba, Ibaraki 305-0044, Japan

⁴ Department of Chemistry & Biochemistry, Florida State University, Tallahassee, Florida 32306-4390, USA

Correspondence should be addressed to Yanqiu Zhu, y.zhu@exeter.ac.uk

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Following the first report on the concentric nature of carbon nanotube (CNTs) in 1991, an era of global nanomaterials research quickly emerged. Over decades of effort, significant progresses have been made by scientists of diverse disciplines from different prospects, which contribute to and become the foundation of the current Nanoscience and Nanotechnology revolution, alongside other three ground breaking inventions of steam engine, electricity, and possibly the internet in our history. It is fair to say that new nanomaterials with unique and fundamentally superior properties, against their conventional bulk forms, naturally become the core element for this revolution. Amongst the seemingly countless nanomaterials that have been documented today, 1-dimensional nanotubes and nanowires (also called nanorods, nanofibres or nanowhiskers) stand out as a class of important structures alongside CNTs, primarily owing to their high aspect ratios against the 0-dimensional nanoparticles, and their lattice stacking features (close to bulk crystal) as opposed to CNTs that formed by wrapping concentric layers of atoms. As a result of the bulk-like stacking within nanowires, elements and compounds of almost any known combinations could be candidates for the construction of new nanowires with specialty, thus offering huge potentials for applications. In fact, successes to date have been achieved in the generation of tens and hundreds of 1D nanowires with the broadest compositional combinations across the periodic table, in contrast to only a handful of nanotubes reported, and more successes are expected in the near future. It is believed that the flourish of new 1D nanomaterial research will continue for some time, and many newly proposed

promising applications based on their unique structural characteristics and versatile properties are waiting to be explored.

Over the last decade, the development in this most rapidly increasing research field has been periodically summarised and reviewed by many colleagues, focusing on one topic or the other regarding specific technical aspects. Given the significant amounts of work involved globally and the unique elongated feature of the 1D nanomaterials, it is important to have a platform that allows active researchers to present their new development in a timely and efficient manner. With this intention in mind, the first special issue “1D Nanomaterials”, containing 16 carefully selected papers, was published in 2010 in the Journal of Nanomaterials and was obviously a moderate success.

Time flies rapidly, and research develops almost at the same pace. Two years on, we feel it is the high time to summarise the hard works focusing on the 1D nanomaterials again, thus leading to the second special issue by the same group of Guest Editors.

Comparing with the first special issue, we have noticed a clear focus shift in the current issue. In the 16 articles presented in the 2010 issue, 12 of which studied the synthesis related subjects, and 6 are property-oriented, with 2 articles covering both the synthesis and property investigation. In terms of research material, CNTs (3), ZnO (3), and TiO₂ (3) shared the most attention, with several other inorganic nanowires. In the present issue in which 31 articles are included (out of 57 manuscript submissions, i.e., ~57% acceptance rate), the research focus and research materials

FIGURE 1: Comparison of research category and subjects included in 2010 and 2011 “1D nanomaterials.”

are clearly diversified. Figure 1 shows the classification of the articles based on broad research category (Synthesis, Property/Application, Device Construction, and Nanocomposites Fabrication), and research materials. 31 articles are not enough for offering a convincing statistic representation, particularly quite a few papers with overlaps across two or more categories; however they nevertheless exhibit the diversity and possibly the direction of current and future research associated with 1D nanomaterials.

Whilst studies on Synthesis (18) and Property (17) remain dominant in numbers, it is encouraging to see a total of 10 papers reporting progresses in Device Construction (7) and Nanocomposite Fabrication (3). This extension offers a solid evidence for importance of such 1D nanomaterials as a key element for the continuous development of nanoscience and nanotechnology.

On the research object materials front, CNT and ZnO nanowires maintain the leading status, followed by TiO₂ nanorods (4 papers), accompanied with a variety of new comers such as InAs, In₂Se₃, VO₂, CeO₂, CuO, GaAs, GaN and and so forth, and several of which appear in complex compositions. We believe this is a fair representation of current activities, and property and application-oriented research emerge strongly.

Overall, as Guest Editors for this second issue, we are pleased with the flourish and diverse research activities in this area. Given the specific 1D and huge aspect ratio characteristics that making nanotubes and nanowires so special, we feel three major research areas are understudied or under-represented in this issue, notably the toxicity, processing, and recycling issues concerning 1D nanomaterials. Whilst a handful reports concentrate on the toxicity behaviour of CNTs, even less research has been carried out to address the recycling issue which not only impacts the economic concerns over 1D nanomaterials in future engineering applications but also directly associates with the end of life disposal of such materials/devices in long term, thus

an environmental issue. The structural characteristics and properties of 1D nanomaterials may change under certain processing conditions such as under Joule effect, or pressure or electric and magnetic field, such processing underpins the stability of 1D nanomaterials. These areas certainly deserve more attention in order for 1D nanomaterials to be safely and economically utilised in practical engineering applications.

Finally, we hope this special issue will be well-received by the reader and we hope to present a further developed and a more balanced research activity in the near future in the next issue.

Yanqiu Zhu
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