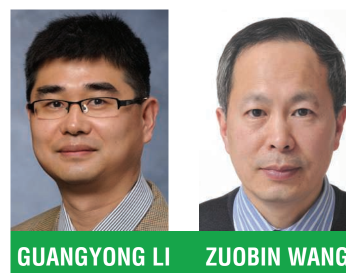
GUEST EDITORIAL

Nanometrology and Nanocharacterization: Keys to the Advancement of Nanotechnology



by GUANGYONG LI AND ZUOBIN WANG

NANOTECHNOLOGY INVOLVES THE development and processing of materials and systems at nanoscale. Therefore, direct observation and the characterization of materials and systems at nanoscale is of critical importance in nanotechnology. Nanometrology is concerned with the science of measurements and characterization at nanoscale. The main research in this field 1) develops or creates new measurement techniques that are able to image nanomaterials and nanodevices and 2) measures the physical parameters of nanomaterials and nanodevices, such as length or size, force, mass, electrical, magnetic, and other properties. Nanocharacterization involves the theoretical and practical aspects of using nanometrological instruments to characterize the physical properties of nanomaterials, nanostructures, nanodevices, and nanosystems at nanoscale resolution. Therefore, nanometrology and nanocharacterization play crucial roles in the advancement of nanoscience and nanotechnology.

Some popular instrumental techniques can be used for measuring or determining the parameters for nanostructures and nanomaterials, including scanning probe microscopy, scanning electron microscopy (SEM), X-ray diffraction, transmission electron microscopy (TEM), field emission SEM as well as some optical microscopy techniques that can break the diffraction limit. This special issue on nanometrology and nanocharacterization features four articles that cover scanning probe microscopy, electron microscopy, and optical microscopy.

In the first article, Gao et al. present their research on how to use an atomic force microscope to study biological cells. Particularly in this study, the selective anticancer effects of *Phellinus linteus* on A431 and HaCat cells and their morphological and mechanical properties were systematically investigated by atomic force microscopy.

Next, Li and Li give a review on the development of scanning ion conductance microscopy (SICM), a scanning probe microscopy technique that works in liquid. SICM is used mostly in biological and other fields due to its ability of noninvasive nanoscale investigation.

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The third article, by Susheng Tan, introduces the fundamentals of TEM and its applications in nanocharacterization. TEM is a critical tool for studies of sizes, shapes, defects, crystal and surface structures, compositions, and electronic states of nanometer-size areas of thin films, nanoparticles, and nanostructured systems.

Finally, Li et al. present a review on a fairly new approach for optical imaging objects with nanoscale resolution using a dielectric microspherical lens (DML), which is able to overcome the optical diffraction limit most likely due to near-field optics properties. The DML-based nanoscopy has been widely studied for optical superresolution imaging because of its practice of label-free noninvasive nanoscale investigation.

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