Materials Science at Nankai: A Special Issue Dedicated to the 100th Anniversary of Nankai University

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This special issue is a collection of Reviews, Progress Reports, and Research News articles by the faculty members from different colleges of Nankai University (NKU), to celebrate its 100th Anniversary. NKU is a historical and prominent university in China. It was established in 1919 by the two famous patriotic educators of China, Mr. Xiu Yan and Mr. Boling Zhang; since then, Nankai has become one of China’s leading universities. It is a key comprehensive and research-oriented university with the widest range of disciplines, featuring a perfect balance between the humanities and the sciences. It is particularly appreciated that Nankai has made substantial contributions to the development of modern chemistry in China. In 2015, Nankai integrated the strengths of chemistry and physics to enrich the field of advanced materials and founded the School of Materials Science and Engineering and the National Institute for Advanced Materials. Both chemistry and materials science at Nankai have been listed as “National Double First-Class” Disciplines of China.

This special issue, featuring 3 Reviews, 17 Progress Reports, and 4 Research News articles, covers a broad spectrum of cutting-edge research of advanced materials including biological materials, energy and optoelectronic materials, catalytical materials, and optical/photonics materials, as well as the promising applications of modern organic/inorganic hybrid materials such as metal–organic frameworks (MOFs) and perovskites. It showcases the research efforts and advances at the interface of chemistry, physics, life science, and materials science on the Nankai campus.

For biological materials, Prof. Yu Liu and co-workers comprehensively review the construction of cyclodextrin-based multi-stimuli-responsive supramolecular assemblies with biological functions such as pH- and redox-responsive drug and gene delivery, enzyme-activated specific cargo release, photoswitchable morphological interconversion, microtubular aggregation, and cell–cell communication (article number 1806158). Prof. Zhimou Yang highlights the unique properties and advantages of another self-assembly approach, namely enzyme-instructed self-assembly (EISA), for the preparation of biofunctional supramolecular nanomaterials and hydrogels from peptides (article number 1805798). Prof. Linqi Shi, Yang Liu, and co-workers discuss the design and fabrication of artificial materials that mimic different kinds of natural molecular chaperones for the regulation of the protein folding and unfolding processes (article number 1805945). Prof. Huixi Zhang presents an overview of the recent progress on molecularly imprinted nanoparticles for biomedical applications, including immunoassays, drug delivery, bioimaging, and biomimetic nanomedicine (article number 1806328). Prof. Qiang Zhao leads the discussion on NO-releasing biomaterial regulation of the stem cell microenvironment in regenerative medicine (article number 1805818). Prof. Weiwei Guo and his co-workers introduce the development of smart DNA hydrogels and DNA microgels for biosensing and biomedical applications (article number 1806538). Prof. Dan Ding and co-workers focus their discussion on the regulation of the photophysical properties of organic/polymer optical agents for promoted cancer phototheranostics (article number 1806331).

In the area of energy materials, Prof. Jiajie Liang and Hongpeng Li present the recent advances in printed micro-supercapacitors, including printable materials and printing technologies (article number 1805864), while Prof. Lifang Jiao and co-workers provide an overview of binder-free electrodes for modern sodium-ion batteries (article number 1806304).

With regard to perovskite materials, Profs. Guo-Ran Li and Xue-Ping Gao provide a comprehensive review of low-cost counter-electrode materials for the replacement of conventional precious-metal electrodes (Pt, Au, and Ag) in the emerging dye- and perovskite-sensitized solar cells (article number 1806478). Prof. Yongsheng Chen and Yongsheng Liu highlight the importance and potential of the recently emerged integrated perovskite/bulk-heterojunction (BHJ) organic solar cells (IPOSCs), which take advantage of tandem cells using both perovskite solar and near-infrared (NIR) BHJ organic solar materials (article number 1805843). Profs. Xiaodan Zhang, Jingshan Luo, and their co-workers focus on semitransparent perovskite solar cells, from both the materials and the devices perspectives (article number 1806474). Perovskites are not only superb for photovoltaics, but are also ideal for light-emitting materials. Prof. Jialiang Xu, Prof. Xian-He Bu, and co-workers summarize the potential of halide perovskites for advanced applications in nonlinear optics (article number 1806736).

For photonic/optical materials and structures, Prof. Shuqi Chen and co-workers review the recent developments of multiplexing and multifunctional metasurfaces, including
their fundamental properties, design strategies, and applications (article number 1805912). Profs. Jingjin Xu, Mengxin Ren, and Wei Cai, on the other hand, introduce metasurfaces that are active in the weak-light nonlinear region, with a special emphasis on all-optical light control (article number 1806317). Furthermore, Profs. Jingjin Xu, Yongfa Kong, and co-workers summarize the recent progress in the research of lithium niobate (LN), one of the most important dielectric crystals, including optical damage, defect simulation, and on-chip device applications (article number 1806452).

Metal–organic frameworks (MOFs), also known as porous coordination polymers, have emerged as a new class of promising crystalline porous materials. Prof. Xian-He Bu and Prof. Tong-Liang Hu shed light on the application of MOF materials for the separation and purification of light hydrocarbons (article number 1806452). Metal–organic frameworks (MOFs), also known as porous coordination polymers, have emerged as a new class of promising crystalline porous materials. Prof. Xian-He Bu and Prof. Tong-Liang Hu shed light on the application of MOF materials for the separation and purification of light hydrocarbons (article number 1806452).

For catalytical materials, Prof. Bin Zhao and his co-workers summarize the applications of MOF materials as catalysts for the formation of C–X bonds in CO₂ chemical fixation (article number 1806163). Prof. Fangyi Cheng and Prof. Jun Chen present self-supported transition-metal-based electrocatalysts for hydrogen and oxygen evolution reactions, including their structural design, controllable synthesis, mechanistic understanding, and strategies for performance enhancement (article number 1806326).

A number of contributions are also presented regarding the construction and application of novel materials and devices. Prof. Yaping Du, Prof. Chunhua Yan, and co-workers provide a comprehensive review of the compositions, syntheses, and applications of ultrathin 2D rare-earth nanomaterials (article number 1806461). Prof. Sihui Zhan and co-workers highlight the recent advances in the synthesis of 3D graphene-based macrostructures and their applications for water treatment (article number 1806843). Prof. Jian Zhu and co-workers discuss the self-limiting assembly approaches for nanoadditive manufacturing of electronic thin films and devices, and their application in various electronic devices (article number 1806480). Prof. Wei Wang and co-workers focus on self-assembly approaches to cluster materials with ordered structures based on heterocluster Janus molecules (article number 1805863).
We are deeply appreciative of the opportunity afforded by *Advanced Materials* to organize this special issue. We are very grateful for the strong support from Dr. Peter Gregory (Editor-in-Chief) and Dr. Duoduo Liang (Deputy Editor) for their invaluable suggestions and kind cooperations. Our gratitude extends to the whole editorial team of *Advanced Materials* for their professionalism throughout the editing process. We also want to express our deep appreciation for the efforts of our colleagues from different colleges of NKU, for their contributions not only to this special issue, but also to the excellence of Materials Science research at Nankai and beyond.

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