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Materials Research at Fudan University

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This Special Issue presents an overview of the best research in advanced materials at Fudan University. Fudan University, one of the most comprehensive universities in China, was founded in Shanghai in 1905. "Fudan", literally meaning "heavenly light shines day after day", indicates inexhaustible self-reliance and industriousness. There are currently 17 schools and 69 departments in the fields of science, engineering, medicine, humanities, history, philosophy, economics, management, education, and arts. Fudan boasts a qualified faculty of 2678 full-time teachers and researchers and currently has an enrollment of 26362 full-time students including 3633 international students. Fudan has always been keeping close relations with major universities around the world, e.g., exchange programs with more than 200 universities and research institutions in about 30 countries and regions. Fudan is also a member of Universitas 21, an international consortium of research-driven universities. Fudan has been one of the world's fastest rising universities and was ranked 90th worldwide by the QS World University Rankings in 2012. It holds the leadership in many research areas, such as partial differential equation in basic mathematics, spintronics in condensed physics, porous materials in synthetic chemistry, genomics in genetics, basic medicine, world economics, and public management.

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Figure 1. A corner at the main campus with the university motto "Extensive scholarship with unyielding dedication and earnest inquiry with close examination". Photograph courtesy of the Publicity Department at Fudan University.

Although the Department of Materials Science at Fudan University was not established until 1986, the materials research at Fudan has a long history, and several departments are currently involved in the development of materials science. To avoid overlapping with most traditional materials departments and schools in the other Chinese universities, and to use the feature of strong fundamental research at Fudan, the Department of Materials Science focuses on "special, new, and functional" materials and devices. 55 faculty members are involved in materials studies in three main directions, i.e., functional polymer films and coatings, semiconducting photoelectric materials and devices, and novel energy materials. The Department of Chemistry consists of faculty members of 105 with about a half in developing new materials by chemical synthesis. Many faculty members served or are serving as editors and editorial board members in distinguished international journals and also taking academic positions in international organizations. A lot of efforts are particularly paid to explore the use of functional inorganic and organic materials in energy and biology. In contrast, the Department of Physics consists of 42 full professors and 23 associate professors with a focus on the materials physics, particularly, the improvement of physical properties in various materials by engineering surfaces. The department runs a State Key Laboratory of Surface Physics and a Key Laboratory of Micro-/Nano-Photonic Structure of the Ministry of Education. The Department of Macromolecular Science combines the fundamental research of polymer materials including condensed polymer physics, macromolecular self-assembly, and biopolymers, and applications of general polymer materials, medical materials,

Figure 2. Library (top two) and Advanced Materials Building (bottom) at Jiangwan campus. Photograph courtesy of the Publicity Department at Fudan University.

automotive materials, and electronic materials. It also owns a State Key Laboratory of Molecular Engineering of Polymers. To meet the newest developments in the international advanced materials field, Fudan founded in 2005 the Laboratory of Advanced Materials, a multidisciplinary research center to promote the reorganization of research strengths by integrating multiple disciplines: physics, chemistry, biology, materials, information, medicine, and environmental science. It is currently focused on three directions: micro/nano electronic materials, photoelectric materials and devices, and functional molecular materials. The Institute of Energy and Collaborative Innovation Center of Chemistry for Energy Materials originated from the Laboratory of Advanced Materials with an emphasis on new energy materials and devices.

As one of the renowned universities in China, Fudan University has become an important institution for research on materials science. More than 300 faculty members with over 2000 graduate students from the Department of Materials Science and Engineering, Department of Chemistry, Department of Physics, Department of Macromolecular Science, Department of Electrical Engineering, Department of Environmental Engineering, School of Medicine, and the Advanced Materials Laboratory are involved in fundamental research related to materials science. Regarding advanced materials, the faculty members have charged main and large national projects, e.g., the researchers at the Laboratory of Advanced Materials have undertaken more than 10 projects from the National Basic Research Program of China. They are also responsive for many key international projects by cooperation with over 20 countries including USA, UK, Germany, France, Australia, Japan, Singapore, and Korea. The annual fund on the material research exceeds 200 million RMB (i.e., 32 million US Dollars), and the publications related to the materials research exceed a number of 1000 in 2012. According to the Essential Science Indicators by Thomson Reuters Corporation, the materials research at Fudan University is ranked 43rd in the world in 2013.

The authors of this Special Issue are from the Department of Chemistry, Department of Materials Science, Department of Physics, Department of Macromolecular Science, State Key Laboratory of Molecular Engineering of Polymers and the Laboratory of Advanced Materials. In this Special Issue particular emphasis is paid to functional inorganic and organic materials for the application in energy, catalysis, and biomedical fields and four typical directions are covered. Several articles are firstly organized to reflect the recent developments in low-dimensional inorganic materials, such as metal oxide nanoparticles, silicon nanowires, and graphene, which represent – nowadays a mainstream direction in the materials science. A lot of research efforts have been devoted to soft matter that is mainly based on organic materials in mimicking nature, e.g., the synthesis of various functional materials by self-assembly. Due to the combined advantages of inorganic and organic components, composite materials have attracted extensive attention for many years, and two representative composites are here highlighted. Finally, increasing interest has recently been the development of new and functional materials by engineering interfaces, and some general strategies with the aim to be applied in energy and biology have been summarized.

Although this Special Issue cannot cover all the materials research at our university, it in a way reflects how chemistry, physics, and biology interplay to contribute to the development of advanced materials. We sincerely hope that it will inspire readers to discover more research breakthroughs at Fudan beyond this publication and will further stimulate exciting collaborations

between Fudan and institutions worldwide. Last but not least, we are greatly grateful to Dr. Peter Gregory and Dr. Carolina Novo, editors of *Advanced Materials*, for the great cooperation and enthusiastic support. Our warm appreciations are also delivered to the whole editorial team of the journal for the efficient and kind work. This Special Issue is greatly indebted to all the scientists working at Fudan, particularly, the contributing authors. Finally, it is published on the occasion of the 20th Anniversary of the Department of Macromolecular Science at Fudan University.

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