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Switching to Bright

He Tian and Stefan Hecht**

Photochromism is the term ascribed to a reversible photoinduced transformation of a molecule, interconverting two isomers of distinctly different colors.[1] Beyond color change, photochromic materials, which allow to reversibly modulate a much more diverse set of properties, continue to demonstrate their advantages in modern materials science.[2] During the more suitably since more broadly defined photoswitching process, several microscopic and macroscopic physical and chemical properties can be modulated by light. These modulated properties range from light absorption, fluorescence emission, refractive index, dielectric constant, conductivity, and magnetism to geometrical structure, reactivity including noncovalent interactions as well as covalent bonding, π-conjugation, and redox behavior. Light as a stimulus offers a unique advantage, as it can be applied in an external, noninvasive fashion and with extremely high spatial and temporal resolution. Until now, fascinating photochromic compounds, most notably diarylethenes, azobenzenes, and spiropyrans have been widely used as important components in remote-controlled functional molecules, assemblies, and materials used in optoelectronic devices for data storage and logic operations as well as biotechnological and pharmacological applications. These achievements have only become possible due to an increasing number of scientists active in the field, who have been devoting tremendous efforts to design novel photoswitchable molecules and exploit their unique functions in emerging applications.

He Tian obtained his Ph.D. degree from East China University of Science and Technology in 1989, Shanghai. Since 1999, he is an appointed Cheung Kong Distinguished Professor by the Education Ministry of China. His current research interests include the syntheses of novel functional organic dyes and polymers as well as development of interdisciplinary materials science that determines the electronic and optical properties of materials.

Stefan Hecht studied chemistry at Humboldt-Universität zu Berlin and obtained his Ph.D. from the University of California at Berkeley in 2001. After establishing his own research group at Freie Universität Berlin and a subsequent position as a group leader at the Max-Planck-Institut für Kohlenforschung in Mülheim an der Ruhr, he returned to his *alma mater* in 2006. His research interests range from synthetic macromolecular and supramolecular chemistry to surface science, with particular focus on utilizing photoswitchable molecules for remote-controlling materials, devices, and processes.

In this special issue, various related aspects spanning from new photoswitches based on different photochromic units all the way to functional applications of photochromic systems, hybrids, and materials, are covered and reported in detail. More specifically, various photochromic systems based on dithienylethene and incorporating additional functional molecules, such as ferrocene or the acid-, photo-, and electrosensitive indolino[2,1-b]oxazolidine unit, are discussed as multifunctional switches and ambichromic dyads displaying gated photochromism. The latter could also be achieved by taking advantage of the pK_a difference of the different isomers the spiropyran–merocyanine system. Azobenzene-containing crosslinkers carrying reactive maleimide groups are used to photocontrol the conformation and, hence, activity of proteins. Two photochromic organic/inorganic hybrid systems are introduced: On the one hand gold nanotriangles could be used to achieve the two-photon isomerization

Prof. H. Tian
Key Laboratory for Advanced Materials and Institute of Fine Chemicals
College of Chemistry and Molecular Engineering
East China University of Science and Technology
Shanghai 200237, P. R. China
E-mail: tianhe@ecust.edu.cn
Prof. S. Hecht
Laboratory of Organic Chemistry and Functional Materials
Department of Chemistry and IRIS Adlershof
Humboldt-Universität zu Berlin
Brook-Taylor-Str. 2, 12489 Berlin, Germany
E-mail: sh@chemie.hu-berlin.de

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of diarylethenes in an enhanced electric field, while on the other hand non-photoresponsive nanoparticles could be reversibly assembled in an aqueous solution using light in combination with a photoacid. Some other applications employing photoswitchable systems are also unraveled and include: i) a real-time dynamic hologram of a realistic 3D object based on fast photochromic imidazole dimers, ii) the supramolecular gelation controlled by upconverting nanoparticles enhancing visible light emission under near-infrared excitation, and iii) a near-infrared rhodamine dye, prepared by photoirradiation and used as a fluorescent probe in cell imaging. Furthermore, photoresponsive polymeric materials are disclosed in this special issue. For example, the photochromic and physical properties of polymer films formed from a terthiophene–diarylethene bifunctional monomer, lost due to aggregation, could be restored by solvent swelling, recovering electro- and photochromic switching as well as control over "on/off" fluorescence with memory. Another example describes a novel metal-free phosphorescent amorphous polymer, which shows intense room-temperature phosphorescence under ambient conditions without extra processing steps and its use as an encryption ink is demonstrated. The special issue is framed by one comprehensive review article, focusing on the recent progress on photoswitchable self-assembling systems with particular emphasis on the emerging fields in fabricating artificial supramolecular systems using photoswitchable compounds as light-responsive units.

Finally, we would like to note that editing this special issue for *the 8th International Symposium on Photochromism 2016 (ISOP 2016)* has been our very pleasurable honor. Although, the recent progress made in the burgeoning field of photochromism cannot comprehensively be covered in a single special issue, we are proud of the result and would like to seize the opportunity to thank all of our colleagues in this area for their excellent contributions. In addition, we express our sincere gratitude to Prof. Xiang Ma (East China University of Science and Technology, Shanghai), who serves as the general secretary of ISOP 2016, and of course to Dr. Anja Wecker and the entire editorial team of *Advanced Optical Materials* for their valuable support and guidance in preparing this special issue.

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