Gated Systems for Multifunctional Optoelectronic Devices

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Advances in the covalent and non-covalent synthesis of materials with precise structural control and the development of analytical tools to probe their properties on multiple and progressively shorter length and time scales provide ample opportunities for the creation of increasingly sophisticated devices with a multitude of functions yet tiny dimensions. In particular "gated" molecular systems that can be addressed and manipulated by external stimuli, most importantly light and electric fields, hold great promise for constructing multifunctional optoelectronic devices and are receiving considerable and increasing attention in recent years. Progress and achievements have been significant and therefore we feel that it is time to reflect the status and discuss the perspectives of this burgeoning and interdisciplinary area of research.

In this special issue experts ranging from synthetic chemists over physicists all the way to device engineers share their most recent results and provide their perspectives and views of the field. Key to multifunctional devices are responsive molecular systems and thus several prominent researchers describe, highlight, and review sophisticated molecules containing functional units such as absorbers, emitters, and charge transporters coupled to switches and receptors. Beyond preparation and characterization of these exciting remote-controlled molecular systems, it is crucial to integrate them into functional devices. Hence, a number of contributions deal with different strategies to organize individual molecules into larger constructs and connect them to the outside world, for example by exploiting interfacial self-assembly and surface patterning approaches as well as interfacing with biology. Last but not least many contributions take the penultimate step and deal with actual devices to proof their principle of operation. The results discussed demonstrate the potential of the entire field for the development of future applications and technologies, in particular in optoelectronics.

It is our belief that this special issue nicely reflects the breadth of the field and conveys the excitement of the individuals involved in this research – we are grateful to their contributions. We are confident that this special issue will therefore not only appeal to the people already involved in the field but also rouse the interest of scientists from outside to enter this fascinating and emerging area of research – it's time to do the switch!

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Stefan Hecht (1974) carried out his undergraduate studies in chemistry at Humboldt University of Berlin and obtained his Ph.D. from the University of California at Berkeley in 2001, working under the guidance of Prof. Jean M. J. Fréchet. After establishing his own research group at Free University Berlin (2001–2004) he was a group leader at the Max-Planck-Institute for Coal Research in Mülheim an der Ruhr (2005–2006). Since 2006 he holds the Chair of Organic Chemistry and Functional Materials in the Department of Chemistry at Humboldt University of Berlin. His research interests revolve around designing functional, in particular photoresponsive, molecular systems and incorporating them in new nanostructured materials and devices.

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