Editorial

Responsive Materials—Designing the Future of Dynamic Functionality

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Welcome to this Thematic Collection of *Materials and Interfaces*, dedicated to the fascinating and rapidly expanding field of *responsive materials*. These "smart" materials are revolutionizing technology by seamlessly integrating dynamic and adaptive functionalities into a wide range of applications, from medical devices and displays to soft robotics and environmental sensors. The ability of these materials to change their properties, including color, shape, or wettability, in response to external stimuli such as light, temperature, or magnetic fields, represents a paradigm shift from passive components to active systems.

The articles in this Thematic Collection highlight the breadth and ingenuity of current research in responsive materials. We begin with innovations in electrochromic and photochromic technologies, which are crucial for next-generation displays and smart windows. The work by Sean Xiao, An Zhang and coworkers on an intrinsically multi-color electrochromic device, as well as the research by Yun Zhang, Wenshou Wang, and coworkers on visible-light-driven black coloration, demonstrates significant strides in achieving stable, high-contrast, and fast-acting color-changing systems.

It then delves into the world of mechanical and structural responsiveness. The research by Hiroshi Fudouzi and coworkers on mechanochromic colloidal crystal sheets and by Yasuhiro Ishida and coworkers on anisotropic hydrogels for directional sensing demonstrates how mechanical deformation can be harnessed to create visual indicators or flexible sensors. Furthermore, the work by Ximin He and coworkers explores the development of angle-independent hydrogel sensors for autonomous soft actuator control, pushing the boundaries of integrated sensing and actuation.

Moving beyond simple sensing, several contributions explore how responsive materials can be used for more complex, controlled actions. Yuhan Zhang, Bo Li, Shichao Niu and coworkers present a magnetically-driven cilium array for precise droplet manipulation, which has profound implications for microfluidics and dynamic displays. Christopher J. Bardeen and coworkers introduce a novel approach to photochemical bubble generation from polymer films, which opens new avenues for applications in medical ultrasound imaging. The article by Toshimitsu Kanai and coworkers highlights the development of chameleon-inspired color-changeable films that are sensitive to human body temperature, expanding the potential for biomimetic applications.

This collection also highlights current research that bridges fundamental material science with innovative applications. The work of Jianping Ge and coworkers on the synthesis of liquid photonic crystals and of Kyosuke Isoda and coworkers on thermally responsive liquid materials showcases the development of new material platforms with versatile functionalities. The articles by Yukikazu Takeoka and coworkers, as well as Keita Kuroiwa and coworkers, further illustrate the molecular-level design of temperature-responsive polymers and spin crossover complexes, respectively, to achieve desired properties.

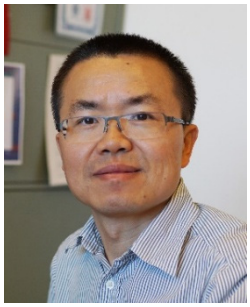
This collection further features articles reviewing cutting-edge research in responsive materials with diverse applications. The article by Younan Xia and coworkers provides a comprehensive overview of light-driven soft actuators, which are distinguished by their ability to undergo significant changes in shape or volume in response to light, offering effective methods for wireless control in soft robotics and advanced manufacturing. The article by Yadong Yin and coworkers reviews the use of colorimetric plasmonic nanosensors for environmental pollution monitoring, demonstrating their potential for rapid and cost-effective detection. The paper by Yanzhao Yang, Wei Feng, Ling Wang, and coworkers provides an up-to-date review on the additive manufacturing of bioinspired structural-color materials, showcasing how new fabrication techniques are enabling complex, durable designs.

These papers collectively illustrate the dynamism and interdisciplinary nature of responsive materials research. They not only present cutting-edge findings but also lay the groundwork for future advancements. As we look ahead, the integration of these smart materials into functional systems promises to address some of the most

pressing challenges in technology, healthcare, and environmental science. We are honored to present this collection of work and hope it inspires further research and collaboration in this exciting field.

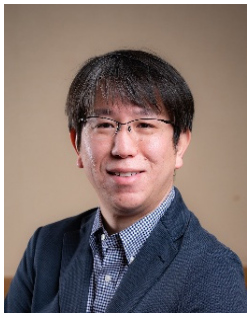
Conflicts of Interest: The authors declare no conflict of interest.

Biographies of Authors



Yadong Yin is a Chemistry Professor at the University of California, Riverside, with an affiliate appointment in Materials Science and Engineering. He earned his B.S. and M.S. in Chemistry from the University of Science and Technology of China in 1996 and 1998, respectively, and his Ph.D. in Materials Science and Engineering from the University of Washington in 2002. In 2003, he worked as a postdoctoral fellow at the University of California, Berkeley, and later at Lawrence Berkeley National Laboratory, before becoming a staff scientist at LBNL in 2005. He joined the faculty at UC Riverside in 2006. His research interests include synthesis, self-assembly, interfacial manipulation, and applications of nanostructured materials.

Hiroshi Fudouzi is a Chief Researcher at the National Institute for Materials Science, NIMS. He earned his B.S. and M.S. in Chemistry from the Kyushu Institute of Technology in 1991 and 1993, respectively, and his Doctor of Engineering from Kyushu University in 2004. In 1993, he worked as a researcher at the National Research Institute of Metals (NRIM), and in 2001, he joined NIMS. He was a visiting scholar in the Department of Chemistry, University of Washington (2002–2003). Since 2019, he has concurrently held the position of Visiting Professor at Nagoya Institute of Technology. His research interests include colloidal crystals, self-assembly, structural color, smart materials that respond to external stimuli, and their applications to address social issues.



Takashi Nakanishi is a Group Leader at the Research Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Japan. He received his Ph.D. Degree within a short period from Nagasaki University in 2000. He was awarded a JSPS Postdoctoral Fellowship (DC1 and PD) and worked at Houston University and Oxford University. He started his research career at NIMS in 2004. Since 2016, he has been in his current position. In 2007–2010, he was also a group leader at the Max Planck Institute of Colloids and Interfaces. He is currently a visiting professor at Hokkaido University. His research focuses on organic/polymer soft materials, particularly optoelectronically functional molecular liquids and their applications in security inks and healthcare sensors.