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• SPECIAL TOPIC • Electrochromics

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Special topic on recent progress in electrochromism

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Electrochromism is a phenomenon known as reversible optical property change of some materials in transmittance, reflectance, or absorbance in response to an external electric potential. With the huge potential market in the fields such as building window, vehicle window and mirror, and display, state-of-the-art researches on electrochromism may possess significant impact on environment, economy and society.

Study on electrochromism was firstly reported in 1930s, and has entered its fast pace since 1980s. C. M. Lampert, C. G. Granqvist *et al.* firstly named "smart window" in electrochromic field. Gentex launched anti-glare mirror to the vehicle market. Since the 21th century, Sage Glass has developed electrochromic glass with large area for building window. Boeing adopted electrochromic window to replace mechanical sun pad in the air plane. More scientists and engineers in China have shown interests in the synthesis, characterization and application of electrochromic materials. In order to highlight these outstanding progresses, we organize this special topic, focusing on the achievements based on conjugated polymers, inorganic materials and multifunctional electrochromic materials and devices.

In the area of conjugated polymers, Lin, Xu *et al.* summarized the research progress of dibenzo pentacycle-centered conjugated polymers via electrochemical polymerization, aiming at providing an insight for the development of novel fused ring-based polymer electrochromic materials. Shi, Meng *et al.* reported two novel 3D electrochromic materials synthesized via multi-position polymerization based on tetra-EDOT substitution, indicating that the introduction of functional group played a vital role in the designing of organic electrochromic materials. Zhu, Meng *et al.* successfully realized a series of electrochromic materials with broad spectrum of electrochromic behaviors and properties which could be finely tuned by molecular structure design. Furthermore, Cao, Yang *et al.* introduced polyethylene glycol into tetraaniline, and the diblock copolymer showed excellent electrochromic properties in terms of switching time and coloration efficiency, which is attributed to the formation of conducting channels and the increase of ion-exchange capacity.

As for inorganic materials, Zhou, Tu *et al.* designed the all-solid-state electrochromic devices based on WO_3 and NiO films, and summarized the strategies to improve their electrochromic performances and further applications of devices. In addition, Ma, Wang *et al.* presented a brief introduction of the recent progress in the application of nanostructures for inorganic electrochromic materials and devices.

To the research on multifunctional electrochromic device, Tong, Li *et al.* explained the operation principles of electrochromic energy storage devices including electrochromic supercapacitors, electrochromic batteries, and the photoelectrochromic devices. They also discussed in detail

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the potential material candidates and possible structures. Besides, Wu, Xu *et al.* reported a newly-designed self-powered electrochromic window for altering its color between deep blue and colorless states according to incident light's on/off states.

It should be mentioned here that we could only report limited achievements in electrochromic field. The progress based on other electrochromic materials such as viologen, organic-metals (In this special topic, Chen, Wang *et al.* have introduced near infrared electrochromic properties of metallodithiolene complexes), or composite materials is not much involved in the special topic.

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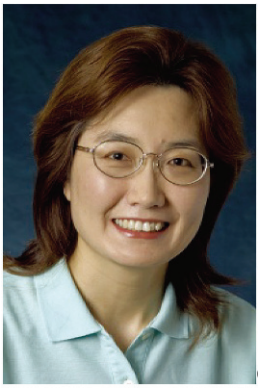
Prof. Xinhua Wan received his B. Eng. degree (1985) from Hefei University of Technology, and M. Eng. degree (1988) and PhD degree (1991) from China Textile University, respectively. He joined Professor Qifeng Zhou's group at the Department of Chemistry, Peking University as a postdoctoral fellow in 1991. He took an associate professor position at Peking University in 1993 and was promoted as a full professor in 1997. He received several awards including National Outstanding Young Investigator Award (National Natural Science Foundation of China) and has been the holder of Changjiang Professorship since 2010. He serves as associate editors of *Australian Journal of Chemistry* and *Acta Polymerica Sinica*, and editorial board members of *Science China Chemistry*, *Chinese Journal of Polymer Science*, and *Polymer Materials Science and Engineering*. His research interests are mainly involved in polymer synthesis and advanced functional materials.



Prof. Chunye Xu completed her PhD studies (1998) and postdoctoral research fellowship (1998/2000) in Japan. As a research associate (2000/2002), at the University of Washington (UW), USA, she initiated her interests in smart materials and structures. Later, she was appointed as a research assistant professor at the UW, and then was promoted to research associate professor in 2009. She has been working as a full professor at University of Science and Technology of China since the end of 2009. She was selected for the "Hundred Talents Program" from Chinese Academic Society in the same year and the "National Thousand Talents Program" of China in 2012. She was honored with the 2014 "International Materials Science Prize" at World Forum on Advanced Materials (POLYCHAR). She has served as the chairman of Chinese National Meeting on Electrochromism since 2014. Her research has focused on electroactive materials and devices, especially on electrochromism.