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电致变色在中国

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电致变色自 20 世纪六十年代被发现以来, 已有五十余年的发展历史。电致变色材料是一种在外加电场下颜色可以发生可逆转变的材料。电致变色材料的可调光谱范围广, 可以实现从可见到中远红外的宽波段调控, 在智能窗、显示、防炫目后视镜、智能热控和伪装等领域具有广泛应用前景。近十年来, 电致变色研究呈现蓬勃发展的态势, 尤其是在中国, 电致变色吸引了纳米材料、真空镀膜、锂离子电池、超级电容器、传感、显示等领域的研究人员涉足这一交叉学科领域, 并逐渐成为研究热点之一。

上期“电致变色材料与器件”专栏(2021, 36(2))中, 我们刊登了《多功能电致变色器件: 从多器件到单器件集成》、《基于氧化钨和氧化镍的电致变色器件研究进展》、《柔性电致变色器件研究进展》、《WO_3 电致变色薄膜离子传输动力过程及其循环稳定性》和《基于高电导率的疏水气相 SiO_2 复合凝胶电解质的高性能电致变色器件》5 篇论文。在本期专栏中, 来自哈尔滨工业大学、中国科学院上海硅酸盐研究所、中国科学院纳米技术与纳米仿生研究所、北京航空航天大学和上海理工大学的电致变色专家贡献了 5 篇论文。李垚教授介绍了无机电致变色在可见–近红外到中远红外波段的反射光谱调控方法、原理和最新研究进展, 对未来无机电致变色材料反射调节的实际应用进行了展望。王金敏教授介绍了电致变色材料与器件、氧化钼薄膜的制备、氧化钼的改性、氧化钼电致变色器件的研究进展, 提出了氧化钼电致变色薄膜与器件当前存在的问题和解决的途径, 并对其发展前景进行了展望。刁训刚教授报道了透过率高、结晶性好的钛酸锂薄膜的旋涂法制备、电致变色性能以及全固态无机电致变色器件的组装。金平实研究员和曹逊研究员报道了利用反应直流磁控溅射技术制备基于 $LiAlO_x/Ta_2O_5/LiAlO_x$ (ATA)三明治结构电解质的全固态电致变色器件。赵志刚研究员报道了具有 F-P 空腔结构的多彩氧化钨薄膜的制备及其可见–红外宽频谱的电致变色性能。

本刊“电致变色材料与器件”专栏聚焦电致变色领域的最新研究进展和未来发展趋势, 希望同行们从中受益。我们期待中国的电致变色研究迅猛发展, 成为引领国际电致变色研究的新潮流。

Electrochromism Research in China

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Electrochromism has been developed for more than 50 years since it was discovered in the 1960s. The optical properties, such as color, transmittance, reflectance and emissivity, of electrochromic materials can be changed reversibly under low applied voltages. Electrochromic materials have a wide range of regulatable spectrum, which can realize the broadband control from visible to mid far infrared. Electrochromic materials show a wide application prospect in the fields of intelligent window, display, anti-glare rearview mirror, intelligent thermal control and camouflage. In the past decade, electrochromism research has shown a trend of vigorous development, especially in China. Electrochromism is attracting researchers in the fields of nanomaterials, vacuum coating, lithium-ion batteries, supercapacitors, sensing and display to get involved in this interdisciplinary field, gradually becoming one of hot research topics.

In the last special issue Electrochromic Materials and Devices (2021, 36(2)), we published 5 papers “Multi-functional Electrochromic Devices: Integration Strategies Based on Multiple and Single Devices”,

“Electrochromic Devices Based on Tungsten Oxide and Nickel Oxide: a Review”, “Progress in Flexible Electrochromic Devices”, “Dynamic Process of Ions Transport and Cyclic Stability of WO_3 Electrochromic Film”, and “High-conductivity Hydrophobic Fumed-SiO_2 Composite Gel Electrolyte for High Performance Electrochromic Devices”. In this special issue, experts working in the field of electrochromism from Harbin Institute of Technology, Shanghai Institute of Ceramics, Chinese Academy of Sciences, Institute of Nanotechnology and Nano-Bionics, Chinese Academy of Sciences, Beihang University and University of Shanghai for Science and Technology contributed 5 papers. LI Yao’s group introduces the methods and principles of regulating the reflectance spectrum in the visible-near-infrared to mid- and far-infrared bands and the latest research progress, and prospects the practical application of inorganic electrochromic materials in future. WANG Jinmin’s group introduces electrochromic materials and devices, preparation of molybdenum oxide films, modification of molybdenum oxide, and the research progress of molybdenum oxide based electrochromic devices. The paper also presents current existing problems and solutions of molybdenum oxide based electrochromic films and devices, and looks forward to their development prospects. DIAO Xungang’s group reports the preparation and electrochromic properties of lithium titanate thin films by spin coating method, and assembly of an all-solid-state inorganic electrochromic device. JIN Pingshi and CAO Xun’s group reports all-solid-state electrochromic devices based on $LiAlO_x/Ta_2O_5/LiAlO_x$ (ATA) sandwich structured electrolyte fabricated by reactive DC magnetron sputtering technique. ZHAO Zhigang’s group reports the preparation of multi-color tungsten oxide films with F-P cavity structure and their wide-spectrum electrochromic properties of visible and infrared spectral regions.

The special issue of Electrochromic Materials and Devices focuses on the latest research progress and future development trends in the field of electrochromism, and hopes that colleagues will benefit from it. It is expected that the electrochromism research in China will develop more rapidly in the future, gradually leading the new trend of international electrochromism research.

王金敏，上海理工大学理学院化学系教授，上海高校特聘教授(东方学者)、曙光学者、浦江人才。2004 年获得中国科学院上海硅酸盐研究所材料科学与工程专业博士学位。2004 年 7 月至 2011 年 8 月，分别在华中科技大学、南昌大学任讲师、副教授。2007 年 3 月至 2011 年 8 月，在新加坡南洋理工大学任博士后研究员。2011 年 9 月至 2020 年 6 月受聘上海第二工业大学特聘学者、教授, 2020 年 7 月加入上海理工大学理学院化学系。自 2007 年以来，一直从事电致变色材料与器件方向的研究。主持完成国家自然科学基金(2 项)、国家重点实验室开放基金(2 项)、上海市曙光计划、上海市浦江人才计划、上海市教委科研创新重点项目等科研项目。在 *Nature Communications* 等期刊发表论文 60 余篇，包括 4 篇邀请综述。论文已被引用 2200 余次，单篇最高被引用 340 余次。为 Wiley 出版社的书籍《Multifunctional Nanocomposites for Energy and Environmental Applications》撰写一章(Electrochromic Materials and Devices: Fundamentals and Nanostructuring Approaches)。申请中国发明专利 17 项，已授权 10 项。担任中国感光学会电致变色专业委员会副主任、中国硅酸盐学会薄膜与涂层分会理事、*Nano-Micro Letters* 助理编辑、*Solar Energy Materials & Solar Cells* 编委、《无机材料学报》编委。
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