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Abstract title

Enhancement of Electrochromic Properties through the Integration of 2D WO3 for Smart Window Applications

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ABSTRACT

Towards development of a highly efficient electrochromic coatings, morphology and size of nanostructures of electrochromic material and their charge insertion capacities play a significant role. Herein, we report a study exploring the structure dependent electrochromic coatings based on the use of 2D tungsten trioxide (WO_3) nanostructures. 2D monoclinic WO_3 nanostructure was prepared by a facile and nonhazardous synthesis and used as working electrodes to fabricate electrochromic devices for smart windows applications. Simple, scalable and spray coating was applied on Fluorine-doped Tin Oxide (FTO) substrate to make ~70% transparent working electrodes. The prepared electrochromic cells of WO_3 structures with targeting ~70% transparency was examined to investigate charge insertion capacities, electrochromic active surface area, and coloration efficiency. Results showed that the 2D WO_3 nanoflakes displayed the highest diffusion coefficient for the intercalation of 1.52×10^{-10} cm^2/s with increased electrochromic active surface area of 25.10 mF/cm^2. Furthermore, the 2D WO_3 nanoflakes indicate a large modulation of optical reflectance (42.63%) with 3.79s shorter response time for bleaching. A greater coloration efficiency (CE) value (89.29 cm^2/C) for 2D WO_3 at 700 nm was achieved. The outcome of this study provides a new insight into designing an efficient electrochromic coating by controlling and optimizing the nanostructures of selective electrochromic materials.

KEY WORDS

Electrochromic, WO_3, Coloration efficiency, Spray coating

BIOGRAPHY

Mahnaz Dadkhah Jazi is a researcher with expertise in nanomaterials and electrochromic technologies, particularly in the development of materials for smart window applications. She currently is a PhD candidate at the University of Adelaide, School of chemical engineering, focusing on the research of next-generation electrochromic materials and their characterization using techniques such as UV-Vis, SEM, and XRD. Her research also extends to environmental pollutant degradation, contributing significantly to sustainable technology advancements. She has published extensively in high-impact journals, making notable contributions to the fields of nanotechnology, material science, and energy solutions

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