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## Enhanced Efficiency of the Honeycomb-structured Film $\text{WO}_3$ Composed of Nanorods for Electrochromic Properties

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### Abstract

To reduce solar heat and glare from visible light, the color of window panes need to be controlled by electronic energy. Metal oxides deposited on these "smart" windows such as  $\text{WO}_3$ ,  $\text{Nb}_2\text{O}_5$ , and  $\text{NiO}$  can change the color of the glass by absorbing visible rays. It is important to control the chemical and physical characteristics of the surface of films and to apply a uniformly thin film to obtain a superior product. In this study, we generated templates as nanostructured  $\text{WO}_3$  monolayers in nanorods with 400 nm-sized polystyrene (PS) beads. Honeycomb structures were prepared from the well-ordered monolayer template with PS beads that were synthesized by wet chemistry. We investigated the enhanced electrochromic (EC) properties of a honeycomb structured  $\text{WO}_3$  thin films which were composed of  $\text{WO}_3$  nanostructures. Nanoarchitectural properties like morphology of films, crystalline phases and the structures of  $\text{WO}_3$  nanoparticles were examined by Field Emission Scanning Electron Microscopy, X-ray diffraction and Transmission Electron Microscopy. And EC standards such as the variation of transmittance, reaction time and

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