Strategies to enhance electrochromic modulation in plasmonic tungsten oxide nanocrystals

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Electrochemical charging in plasmonic tungsten oxide nanocrystals induces visible and near-infrared modulation, due to localized surface plasmon resonance, promising for next-generation electrochromic windows. Ion insertion into crystal lattice occurs in the electrochemical process, thus understanding the crystalline nature of tungsten oxide can improve modulation properties. In this talk, we discuss how to improve overall optical modulation by electrochemical methods from tungsten oxide nanocrystals. First, coloration efficiency (optical density increase per injected charge density) in monoclinic $WO_{2.72}$ nanocrystal thin films can be enhanced by selectively intercalating Na^+ into the optically active hexagonal tunnel sites. Lastly, we talk about how interplay of shape and crystalline anisotropy in hexagonal $Cs:WO_3$ nanocrystal thin films influences on the charge capacity and coloration efficiency both of which are major factors that determine the degree of electrochromic modulation.