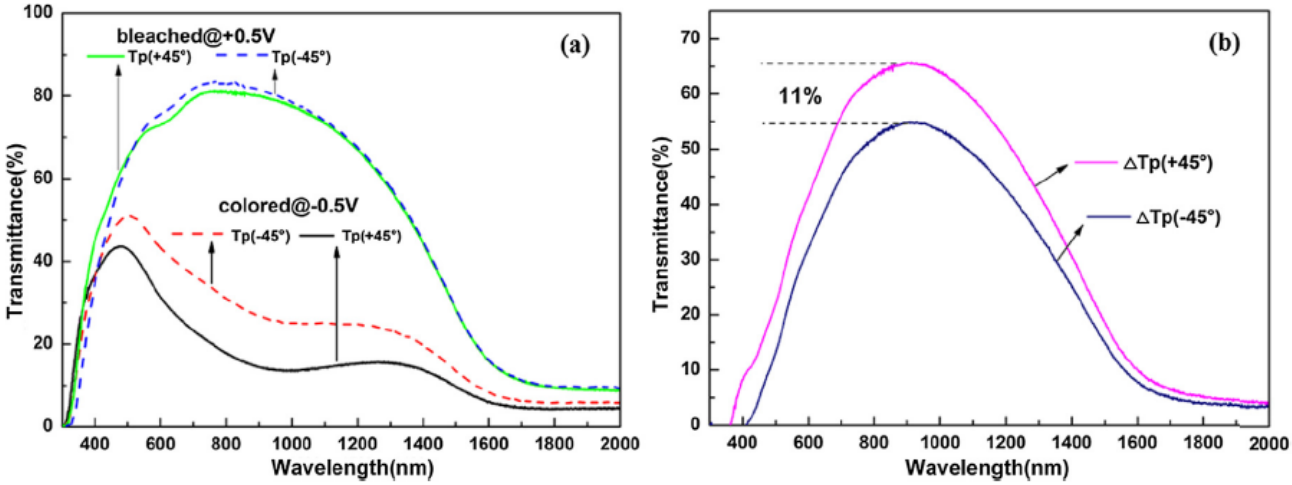
Electrochromic behavior of WO3 thin films prepared by GLAD

WO3 thin films fabricated by glancing angle deposition (GLAD) are proposed as excellent electrochromic coatings with favorable ion diffusion. A = 500-nm film prepared by GLAD had a relatively large transmittance
modulation. The crystallization structure, surface morphology, chemical state, optical and electrochromic properties of WO3 thin films were systematically characterized upon annealing treatment. Compared with annealed WO3 porous nanostructured films, the amorphous as-deposited films exhibited a high coloration efficiency and stable reversibility. Furthermore, the GLAD WO3 films exhibit the tunable angular selectivity under illumination with p-polarized light because of the birefringence, which could extend the application range of nanostructured films in the electrochromic field.



Transmittance of WO3 films under ±45□ p-polarized light: (a) colored and bleached state; (b) optical contrasts (%DT). (For interpretation of the references to colour in
this figure legend, the reader is referred to the web version of this article.)

WO3 thin films were fabricated by glancing angle deposition technique (GLAD) and annealed at different temperatures. The WO3 films begin to crystallize at around 300 □C. Comparing with the annealed films, the as-grown GLAD WO3 film exhibits relatively optimum electrochromic properties, along with a satisfactory cycling stability and large optical modulation (42.2%, 633 nm), because the loose structure facilitated fast ion diffusion and rapid color alteration. Furthermore, a noteworthy feature of tilted columnar structured films is that under illumination with p polarized light, the transmittance modulation contrast between the +45 and -45 incidence can be up to 11%. The angular selectivity of the colored and bleached states of GLAD WO3 films illuminated with p-polarized light can be tuned by applying different voltages, which provides new application features and development potential.

For more information: https://doi.org/10.1016/j.apsusc.2018.03.248