Crystal Phase-dependent Electrochromic Performance of Porous Titanium Dioxide Nanotube Films

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doi: 10.20964/2021.05.41

Received: 27 January 2021 / Accepted: 2 March 2021 / Published: 31 March 2021

Electrochromic porous TiO₂ nanotube films with different structural phases were successfully coated on fluorine-doped tin oxide (FTO) glasses by a doctor-blade method with subsequent post-annealing treatment. The TiO₂ crystal phases can be easily tailored via simple post-annealing treatment. The electrochromic performance of coated films was found to be strongly dependent on the TiO₂ crystal phase. An improved optical modulation range was obtained for TiO₂(B) (28.1%) compared to TiO₂ anatase (4.5%) and anatase/TiO₂(B) mixed phases (10%) films by measuring in-situ optical transmittance measurement at 633 nm upon the polarized potential between -0.8V (colored state) and 1.0 V (bleached state). Moreover, the coloration efficiency of pure TiO₂(B) nanotube films reached a value as high as 66.69 cm²/C at 633 nm. These results can be ascribed to the enhanced Li⁺ diffusion coefficient of the TiO₂(B) nanotube film with its open framework structure, which can effectively facilitate the transport of Li⁺ ions during the coloring process. This work demonstrates great potential use of TiO₂(B) films in large-scale electrochromic applications .

Keywords: TiO₂ nanotube films; transmittance spectra; electrochromic performance; Li⁺ diffusion coefficient; TiO₂(B) phase

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