

Highly-efficient electrochromic performance of nanostructured TiO₂ films made by doctor blade technique

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Abstract: Electrochromic TiO₂ anatase thin films on F-doped tin oxide (FTO) substrates were prepared by doctor blade method using a colloidal solution of titanium oxide with particles of 15 nm in size. The films were transparent in the visible range and well colored in a solution of 1 M LiClO₄ in propylene carbonate. The transmittances of the colored films were found to be strongly dependent on the Li inserted charges. The response time of the electrochromic device coloration was found to be as small as 2 s for a 1 cm² sample and the coloration efficiency at a wavelength of 550 nm reached a value as high as 33.7 cm² C⁻¹ for a 600 nm thick nanocrystalline-TiO₂ on a FTO-coated glass substrate. Combining the experimental data obtained from in situ transmittance spectra and in situ X-ray diffraction analysis with the data from chronoamperometric measurements, it was clearly demonstrated that Li insertion (extraction) into (out of) the TiO₂ anatase films resulted in the formation (disappearance) of the Li_{0.5}TiO₂ compound. Potential application of nanocrystalline porous TiO₂ films in large-area electrochromic windows may be considered.

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