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Synthesis of Mesoporous TiO2 by using PS-b-P4VP as template block co-polymer: Fabrication and Analysis

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Mesoporous titania have been extensively studied owing to their high surface area, unique electronic and optical properties and applications in photocatalysis and dye sensitized solar cells[1]. An optimal mesopore size of the nanostructured titania film plays a significant role in the device efficiency improvement.
In this work, the bottom up approach of sol-gel synthesis has been used to fabricate titanium oxide films. As a template the diblock copolymer polystyrene-b-poly(4-vinylpyridine) (PS-b-P4VP) is used to define the structure and titanium tetra isopropoxide (TTIP) as the precursor. The amphiphilic block copolymer PS-b-P4VP undergoes phase separation and self-assembly due to a good-bad solvent pair, namely N,N-dimethylformamide (DMF) and acetic acid (CH3COOH). By adjusting the weight ratio of acetic acid and TTIP, the mesoporous sponge-like titania films are obtained after template removal by calcination.
The surface and inner morphology are explored by optimal microscopy (OM), scanning electron microscopy (SEM) and grazing incidence small-angle X-ray scattering (GISAXS). Furthermore, the anatase phase of the crystalline titania films is verified by X-ray diffraction. The transmittance is investigated by ultra-visible spectroscopy (UV-vis).

References

[1] Yonghui Deng, Jing Wei, Zhenkun Sun and Dongyuan Zhao, Chem. Soc. Rev., 2013, 42, 4054

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