

Synthesis of 2-Dimensional TiO₂ Mesoporous Structure for Dye-Sensitized Solar Cells

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The present studies are focused on the synthesis of a 2-dimensional porous nanostructure of TiO₂ for the dye-sensitized solar cell (DSSC) application. Currently used DSSC technology utilizes approx. 5 μm size thick film of TiO₂ nanocrystals, which provides sufficient anchoring sites for dye sensitizers and yields reasonably well energy conversion [1]. In the present study, we investigated synthesis of a mesoporous TiO₂ thin-film by using two approaches involving sol-gel and supercritical CO₂ assisted infusion of Ti in pre-deposited surfactant film. In the sol-gel approach, the films were made by spin-coating a sol-solution containing a non-ionic surfactant, Ti-alkoxide precursor, and an acid catalyst on conductive glass substrates at the speed of 1000-5000 rpm. The films were dried at room temperature and soaked in ethanol at 60°C for 48 h to remove the surfactant. After Removal of the surfactant template, the films were calcined at 400-450°C [2]. The TEM images showed mesopores in the range of 4-8 nm and atomic force microscopy (AFM) exhibited an ordered arrangement of the mesopores with the surface roughness of about 2 nm over an area of 600 nm² (see Figure 1a-c). Mesoporous conformal films are desired for higher surface coverage and less dye aggregation, which may translate into higher energy conversion. The other approach (see Figure 1d) relies on the principle of infusion followed by selective condensation of Ti-precursor in surfactant films by the supercritical CO₂ [3]. The effect of surfactant concentration and swelling agent will be presented with respect to pore size and ordering of the pores and these results will be compared with the films prepared by sol-gel approach.

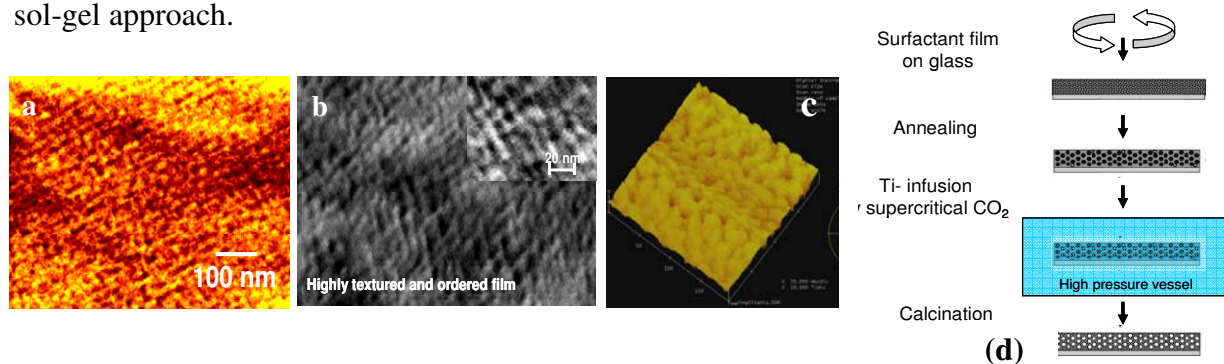


Figure 1a&b) SEM images of the highly textured TiO₂ film prepared by PEG-400 templating, **c)** AFM image of the TiO₂ film showing a highly conformal film with mesoporous structure and **d)** schematic showing supercritical fluid assisted infusion followed by Ti condensation in surfactant film.

References

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