Mesoporous SnO_2 Microspheres: Synthesis, Characterization, and Application in Enhanced Dye-sensitized Solar Cells and Lithium Batteries

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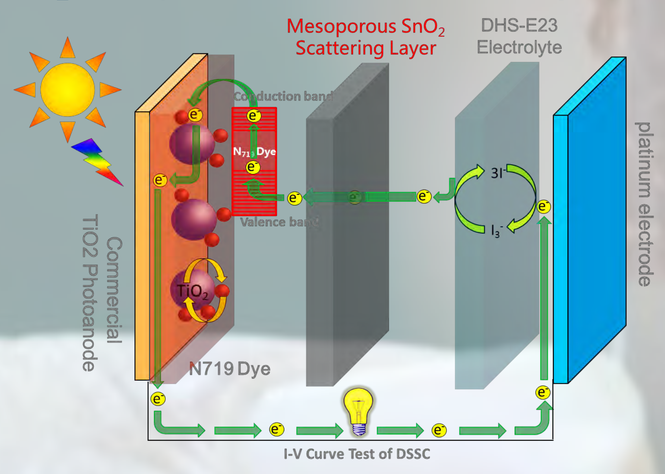
Introduction

This paper reports firstly on synthesis of mesoporous SnO_2 microspheres by a spray reaction process after calcination at 600-800℃.

Using the mesoporous SnO_2 microspheres as anode scattering layer, dye-sensitized solar cells (DSSCs) are assembled with TiO_2 nanoparticles as the bottom layer.



SnO2 microspheres layer significantly enhances light harvesting and energy conversion efficiencies of cells. A maximum conversion efficiency of **6.0%** was obtained for this bilayered DSSCs.

Synthesis

Mesoporous SnO_2 spheres were, for the first time, prepared through a **spray reaction** process proposed by our group and the detailed procedure was described elsewhere.

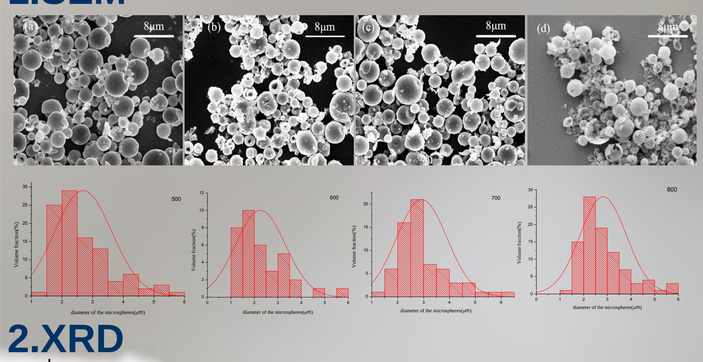
Briefly, a 30wt% aqueous solution of $SnCl_4$ was first atomized in the aerosol generator. After that the aerosols of tin salt solution reacted with NH_3 gas from ammonia cylinder in the reactor, forming the spherical SnO_2 precursor particles.

The collected SnO_2 precursor spheres were washed several times with distilled water and washed twice with anhydrous ethanol and then dried at low fire for 12 min in a microwave oven.

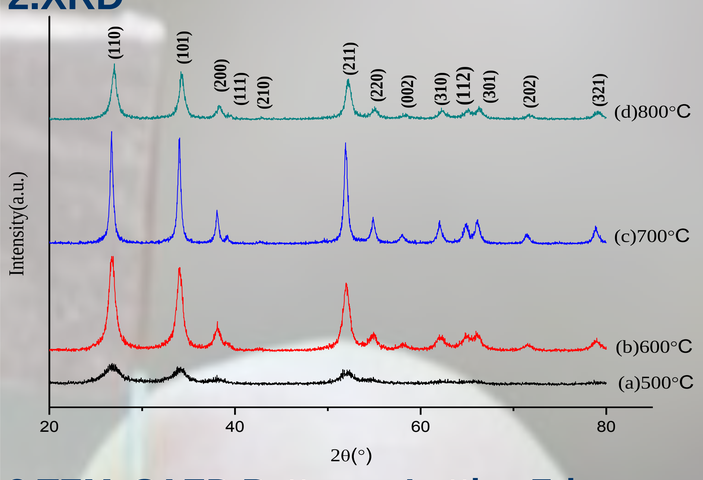
Finally, the precursor spheres were calcined in air at 500 ℃, 600 ℃, 700 ℃, and 800 ℃ for 2 h, respectively.

Characterization

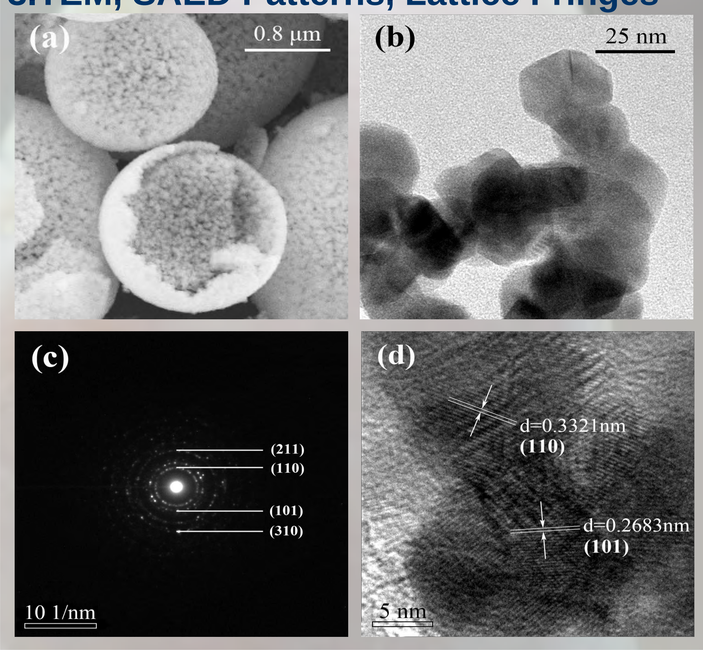
1.SEM



2.XRD

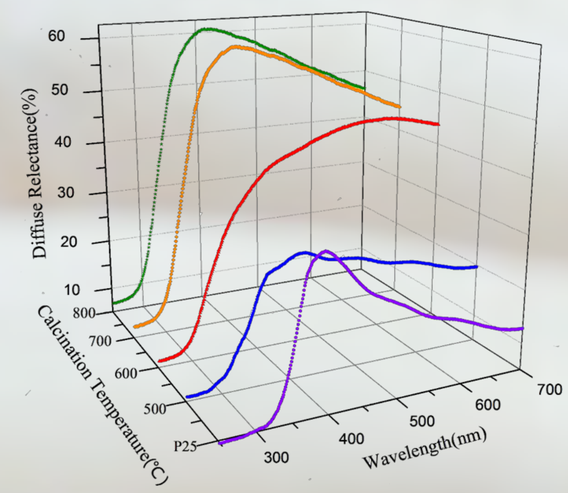


3.TEM, SAED Patterns, Lattice Fringes

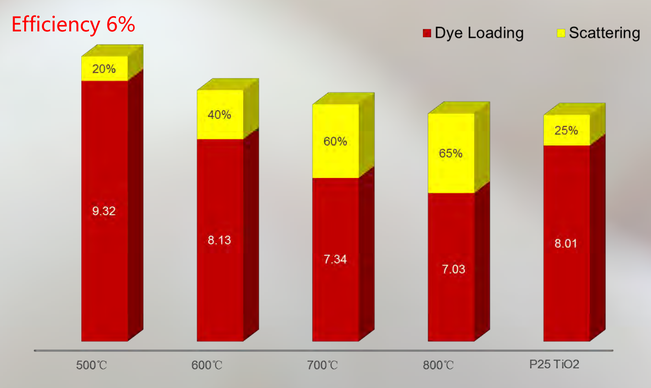


Application in DSSCs

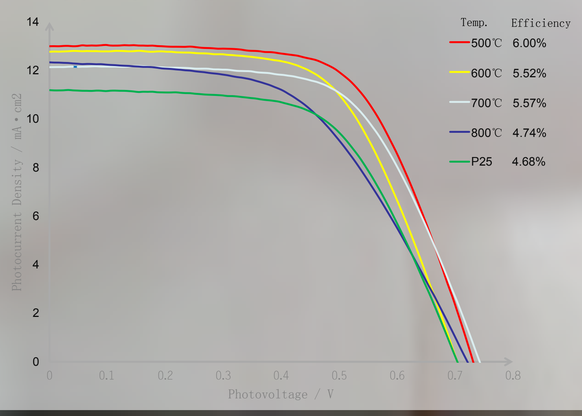
1. Light Scattering



2. Dye Loading

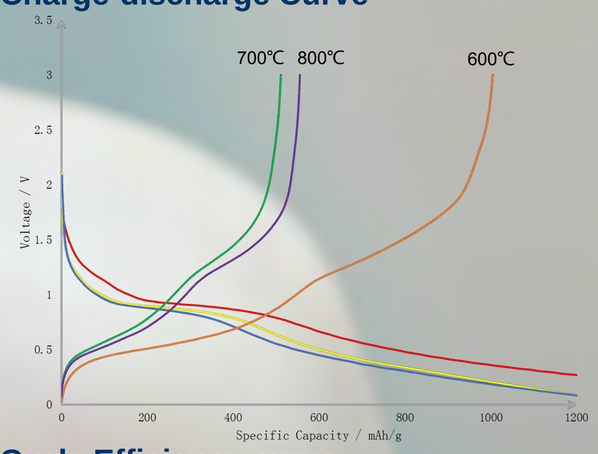


3. I-V Curve Test

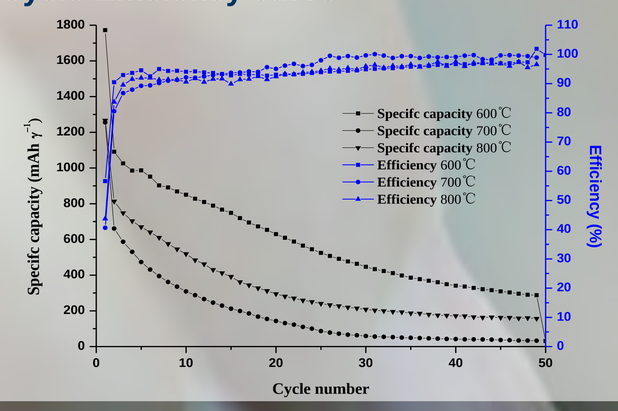


Application in Lithium Batteries

1. Charge-discharge Curve



2. Cycle Efficiency curve



Conclusion

Enhanced DSSC based on the photoelectrodes made from bifunctional hierarchical spherical SnO_2, which was synthesized by novel **spray reaction**, achieved a high energy conversion efficiency of **6.0%.**

Literature Cited

-B. O'Regan, M. Graetzel. A low-cost, high-efficiency solar cell based on dye-sensitized colloidal TiO_2 films[J].Nature. 1991.(353) 737.

-Lei Yang et al. Light harvesting enhancement for dye-sensitized solar cells by novel anode containing cauliflower-like TiO_2 spheres [J]. J. Power Sources.2008.370–376.

-Jing Chen et al. Hollow SnO_2 microspheres for high-efficiency bilayered dye sensitized solar cell [J]. RSC Advances. 2012.2.7384–7387.

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