

TITLE

Hierarchical nanostructured TiO₂ for solar cells application

**Sawanta S. Mali¹, C. A. Betty²,
R. S. Devan³, Y. R. Ma³ and P. N.
Bhosale⁴ and P. S. Patil¹**

¹Department of Physics, Shivaji University, Kolhapur, India

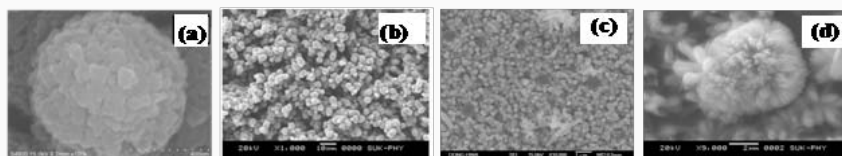
²Chemistry Division, Bhabha Atomic Research Centre, Mumbai, India

³Department of Physics, National Dong Hwa University, Hualien, Taiwan

⁴Department of Chemistry, Shivaji University, Kolhapur, India

Titanium oxide (TiO₂) is one of the most important functional semiconducting materials found in three different crystalline phases: anatase, rutile and brookite. The dye-sensitized solar cells (DSSCs), and quantum dot sensitized solar cells (QDSSCs) have been taken as the most promising power sources for a new generation of solar cells due to their relatively low manufacturing cost and high energy conversion efficiency with a facile fabrication process. It is well known that the morphology and crystallinity of TiO₂ play important roles in solar cells. These nanostructures result in additional absorption-scattering-absorption and trapped electrons at grain boundaries.

A simple and low temperature hydrothermal process is employed to synthesize exotic nanostructures of TiO₂. The chloride, acetylacetonate, butoxide and isopropoxide salts of titanium are used to grow high quality thin films comprising anatase nanocorals, anatase nanorods, rutile microspheres and rutile nanoflowers respectively. A novel route of addition of room temperature ionic liquid is used to synthesize hitherto unexplored nano-morphologies. The structural, optical and morphological properties are studied with the aid of plethora of techniques. The influence of these exotic nano-morphologies on the performance of their solar cells is investigated in detail. The results are interpreted, the underlying physical processes are apprehended and the importance of morphological architectures is discussed. Encouraging results are obtained.



Keywords: Solar cell based on nanocorals, microspheres, nanorods, nanoflowers.

Biography

Sawanta S. Mali obtained his M. Sc. degree in Material Sciences from Shivaji University, Kolhapur, India in 2008. He is currently a Ph. D student under the supervision of Prof. Pramod S. Patil at the Shivaji University, Kolhapur in India. He is recipient of prestigious Material Research Society of India (MRSI)-2010 and Young Scientist awards 2010 by Department of Science and Technology, New Delhi. His research interests include functional nanomaterials synthesis by hydrothermal technique with the direction of application in DSSCs and hybrid solar cells.