Impact of TiO_2 Nanorods-Nanoparticles Bilayer Assembly in the Performance of Dye Sensitized Solar Cells

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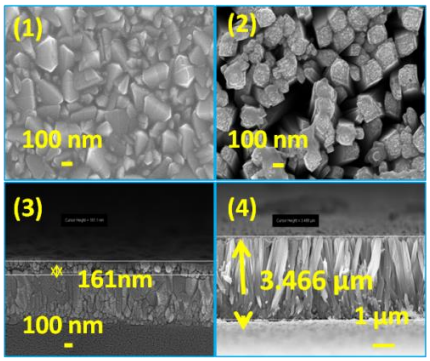
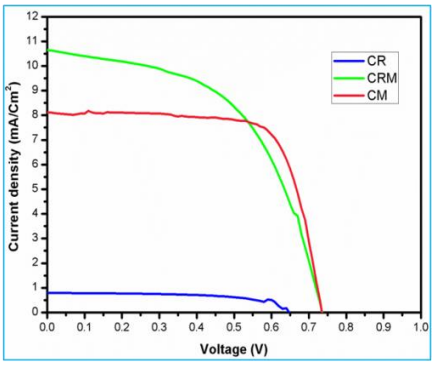
Abstract

The photo anodes in dye sensitized solar cells (DSSCs) with two different morphologies such as one dimensional nanorods and nanoparticles of TiO_2 were utilized for improving the short circuit current density of the device. The synergistic effect of both structures offer high Jsc by providing better pathway for the electron transportation through one dimensional nanorod morphology and efficient light absorption due to more dye adsorption on the mesoporous nanoparticles. The performance analysis of the dye sensitized solar cells were done by using photo anodes of three different combinations, such as compact layer with mesoporous nanoparticles (CM), compact layer with nanorod structure (CR) and finally compact layer with both the nanorods and mesoporous nanoparticle as a bilayer assembly (CRM).The FESEM images confirm the presence of vertically aligned nanorods and they are perpendicular to the substrate surface. XRD and RAMAN studies confirm the crystalline nature of synthesized bilayer film was a mixture of anatase and rutile phase of TiO_2. The absorption and emission properties for the synthesized samples were studied using UV-Vis and Photoluminescence (PL) spectroscopy. The efficiency of the solar cells with the photo anodes of CR, CM and CRM were found to be 0.30%, 4.41% and 4.23% respectively.





First figure shows the FESEM images of the top view of compact layer and TiO_2 nanorods (1&2), cross sectional view of compact layer and TiO_2 nanorods (3&4) and second figure represents J-V graph of CR, CM layers and CRM bilayer assembly.

Keywords: Anatase TiO_2, Rutile TiO_2, Nanorods, Bilayer assembly, DSSCs.