Synthesis of TiO_2 nanocrystalline powder by basic route and its application for dye sensitized solar cell (DSSC)

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Abstract

Herein, the N719 sensitized solar cell characteristics of TiO_2 is presented. The Ti-hydroxide precursor for TiO_2 is prepared by using simple using simple precipitation route in basic conditions at 60 to 70 °C with titanium tetra isopropoxide (TTIP) and sodium hydroxide as starting materials. The as-prepared Ti-hydroxide precursor is annealed at 350 and 450 °C for 2 hr. The as-annealed powders are characterized by using X-ray diffraction (XRD), UV-Visible spectroscopy and scanning electron microscopy (SEM). The XRD studies indicated the formation phase pure TiO_2 powders with anatase symmetry. The morphological studies showed the nanocrystalline nature of the powders. The N719 dye sensitized solar cell is fabricated by using photoanode prepared with 450 °C annealed TiO_2 powder. The dye sensitized solar cell characteristics are found to be J_{sc} = 1.95 $mAcm^{-2}$, V_{oc} = 607 mV, FF = 0.60 and η = 0.723 % under illumination with light of 100 mW cm^2 intensity.

Keywords: TiO_2; TTIP; Basic route; XRD; SEM; DSSC.

1. Introduction

During last two decades, the dye sensitized solar cells (DSSCs) have become very much popular because of their high photo-conversion efficiency, low fabrication cost and easy manufacturing procedure [1 - 4]. DSSC is a sandwiched assembly of photoanode, dye, iodine based electrolyte and counter electrode. The electron generated with absorption of light by dye is transferred to photoanode and then passed through load reach at counter electrode. Here, the electrolyte plays its role and excited dye is regenerated.

In the recent years, the TiO_2 is found to be very useful material for different applications like photovoltaic cells, photocatalyst, environmental application, water splitting, gas sensors, super hydrophilic and self cleaning [5-7] due to its better thermal stability, biocompatibility, non-toxicity, strong oxidized