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Synthesis and optical properties investigation of TiO_2 nanotubes for use in polymer gel-state dye sensitized solar cells

Z Seidalilir[1,2] and R Malekfar[3]

1. Department of Physics, Faculty of Science, Shahid Chamran University of Ahvaz, Ahvaz, Iran
2. Center for Research on Laser and Plasma, Shahid Chamran University of Ahvaz, Ahvaz, Iran
3. Department of Physics, Faculty of Science, Tarbiat Modares University, Tehran, Iran

E-mail: z.seidalilir@scu.ac.ir

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Abstract

In this paper highly ordered TiO_2 nanotube (TNT) arrays were synthesized using potentiostatic anodization of Ti foil for 12 h at voltage of 60 V and used in polymer gel-state dye sensitized solar cells (DSSCs). To investigate the morphology and optical properties of the TNTs, scanning electron microscopy (SEM), Raman spectroscopy and X-ray diffraction techniques (XRD) have been used. The average diameter and length of the TNTs were 100 nm and 30 µm, respectively. XRD and Raman measurements indicated the pure anatase phase of TNTs. A polymer poly(methyl metacrylate- *co*-methacrylic acid) (PMMA-MA) was mixed with a 3-methoxypropionitrile (MPN) based liquid electrolyte to prepare a gel-state polymer electrolyte. The prepared electrolytes containing varied concentrations of PMMA-MA were characterized by electrochemical impedance spectroscopy (EIS). Power conversion efficiency of NT based DSSCs using a polymer gel electrolyte containing PMMA-MA was comparable with that of the corresponding liquid counterpart.

Keywords: dye sensitized solar cell, polymer-gel electrolyte, TiO_2 nanotubes, PMMA-MA

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