28p-G18-9

Photovoltaic performances of DSSC composed of nanospheres-coated photoelectrode

Varishetty Madhu Mohan, Kenji Murakami
Research Institute of Electronics, Shizuoka University
E-mail: rskmura@ipc.shizuoka.ac.jp

Introduction

Various sizes of TiO_2 nanospheres were synthesized and coated by using a simple spray technique as a scattering layer for the TiO_2 photoelectrode of dye-sensitized solar cells (DSSCs). The current–voltage measurements showed that the scattering layer with spheres of 450 nm in diameter improved the photovoltaic performances.

Experimental

TiO_2 photoelectrodes were prepared by the spray pyrolysis technique using TiO_2 powder (P25) and colloidal solution (TKC-302). Various sizes of TiO_2 hollow nanospheres were synthesized by a hydrolysis followed by the hydrothermal treatment using different water content and titanium isopropoxide (TTIP) while the remaining components such as methylamine, ethanol and acetonitrile were kept as a constant.

The prepared spheres' diameters were confirmed by the scanning electron microscopy (SEM). These spheres were coated with the TiO_2 colloidal solution as a scattering layer on the conventional TiO_2 photoelectrode.

Results and Discussion

I-V measurements and reflex spectra revealed that the scattering layer with nanospheres of 450 nm in diameter coated on the photoelectrode gives the improved photovoltaic performances and the highest light reflectance compared to the nanospheres of other diameters. Figure shows the SEM image of prepared nanospheres.

In the present study, the best energy conversion efficiency of 9.56% was obtained for the photoelectrode coated with the spheres of 450 nm in diameter as a scattering layer, while the conventional photoelectrode without the layer gave that of 8.4%.

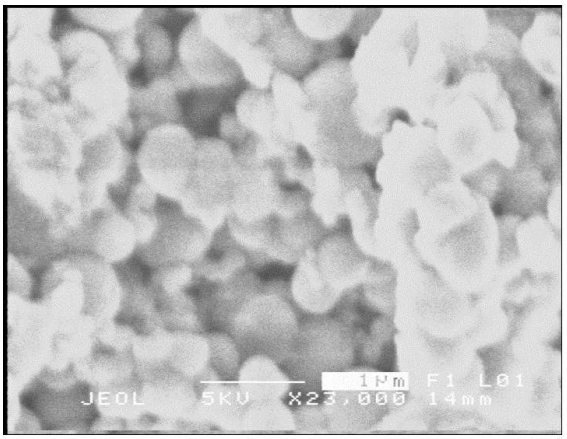

Figure SEM image of the prepared nanospheres whose average diameter is 450 nm

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