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Synthesis of ultrafine ZnO nanoparticles and their application to dye sensitized solar cell

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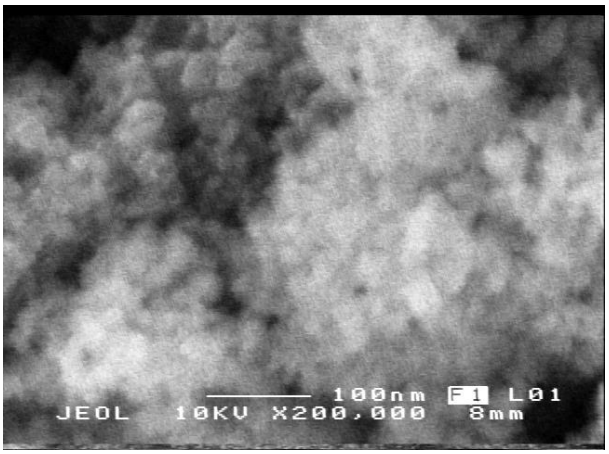
Introduction

Dye sensitized solar cells (DSSCs) based on wide band gap nnocrystalline TiO_2 semiconductor loaded with dyes have attracted a significant attention as low cost alternatives to the conventional silicon solar cells. To date many semi-conductor oxides have been applied as photoelectrode materials, such as ZnO, Nb_2O_5, SnO_2, WO_3, Zn_2SnO_4 etc. Among them the nanocrystalline TiO_2 and ZnO are found to be the most suitable materials. ZnO nanostructures, in particular, could be a promising alternative material to TiO_2 owing to its similar band gap, much higher electron mobility and comparable electron injection efficiency. Hence we demonstrate DSSCs based on two different sizes of ZnO nanoparticles.

Experimental

First, we prepared photoelectrode from ultrafine ZnO commercial powder (FINEX-50, SAKAI Chemical, ~20 nm) and Triton X-100 by using simple spray pyrolysis technique. Second, we synthesised ZnO nanoparticles with diameter less than 10nm through simple sol gel method. In this method we used $(CH_3COO)_2Zn.2H_2O$ (Wako) and $(LiOH.H_2O)$ (Wako) as precursors. The well prepared nanoparticles were confirmed by the XRD structural analysis and the SEM morphological study.



Results and Discussion

The XRD reveals that the prepared ZnO nanoparticles show hexagonal phase. No other impurities were not detected.

SEM image shown in above figure reveals that the prepared particles were around 10 nm in diameter and have higher surface area compared to the commercial powder. The lower size and higher surface area particles would be expected more dye adsorption and enhance the photovoltaic parameters.

We fabricate the DSSCs based on two sizes of ZnO nanoparticles using the N719 dye solution and compares their photovoltaic performances. The optimum detailed experimental conditions and results will be discussed.