

A facile synthesis of disk-shaped TiO_2 as a scattering layer in dye-sensitized solar cells

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Disk shaped TiO_2 (DS- TiO_2) was prepared by one-step process using titanium(IV) isopropoxide (TTIP), ethyl cellulose (EC), and mixed solvent, tetrahydrofuran (THF) and toluene. EC has planar structure and it plays significant role in forming two-dimensional disk-shaped structure of TiO_2 in this process. The structure of anatase DS- TiO_2 was characterized by scanning electron microscopy (SEM), transmission electron microscopy (TEM), and X-ray photospectroscopy (XPS). The use of DS- TiO_2 as a light scattering layer on nano-crystalline TiO_2 (NC- TiO_2) in quasi-solid-state dye-sensitized solar cells (qssDSSCs) showed better performance (5.0%) than that of NC- TiO_2 film only. The increased J_{sc} of qssDSSCs causing the increase in dye loading and light scattering by introduction of DS- TiO_2 is a major contributor to improved performance and it was observed through UV-visible reflectance spectra and incident photon-to-electron conversion efficiency (IPCE) measurements. When using a solid electrolyte, poly((1-(4-ethenylphenyl)methyl)-3-butyl-imidazolium iodide) (PEBII) with DS- TiO_2 layer, 6.6% of performance was obtained.