NW-P001

Fabrication of Flexible Solid-state Dye-sensitized TiO_2 Nanotube Solar Cell Using UV-curable NOA

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TiO_2 anatase nanotube arrays (NTAs) were grown by electrochemical anodization and followed annealing of Ti foil. Ethylene glycol/NH_4F-based organic electrolyte was used for electrolyte solution and using second anodization process to obtain free-standing NTAs. After obtaining NTAs, ITO film was deposited by sputtering process on bottom of NTAs. UV-curable NOA was used for attach free-standing NTAs on flexible plastic substrate (PEN). Solid state electrolyte (spiro-OMeTAD) was coated via spin-coating method on top of attached NTAs. Ag was deposited as a counter electrode. Under AM 1.5 simulated sunlight, optical characteristics of devices were investigated. In order to use flexible polymer substrate, processes have to be conducted at low temperature. In case of TiO_2 nano particles (NPs), however, crystallization of NPs at high temperature above 450°C is required. Because NTAs were conducted high temperature annealing process before NTAs transfer to PEN, it is favorable for using PEN as flexible substrate. Fabricated flexible solid-state DSSCs make possible the preventing of liquid electrolyte corrosion and leakage, various application.

Keywords: flexible, TiO_2 nanotube, solid-state, NOA