

Effects of Anodization Parameters and $TiCl_4$ treatments on TiO_2 Nanotubes Morphology for Improving Performance of Dye-Sensitized Solar Cells

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Effects of anodization parameters on the growth behavior and top morphology of TiO_2 nanotubes were studied. Five TiO_2 nanostructures with different top morphologies, including nanopores, nanotubes, nanohexagons, nanonet and nanograss as shown below, were obtained through an electrochemical anodization of Ti foil, by varying the anodization parameters, including anodization time, anodization temperature and deionized water content, due to their effects on growth sequence of the nanotubes.
Dye-sensitized solar cells (DSSCs) based on the photoanodes fabricated with the TiO_2 nanotubes of nanohexagon morphology showed the highest power conversion efficiency of 5.29%.

Moreover, decorations of the TiO_2 nanohexagons with TiO_2 nanoparticles derived from $TiCl_4$ with different molar concentrations were also explored, in order to further improve the performance of the DSSCs. It was found that the DSSCs based on the TiO_2 nanohexagons photoanode treated with 0.2 M $TiCl_4$ showed a maximum short-circuit current density of 14.37 mA/cm^2, a power conversion efficiency of 6.64% and an incident photon-to-current conversion efficiency of 68%, due to the increased effectiveness in electron transport and enhanced surface area for dye adsorption.

Biography

Dr. Hafiz Muhammad Asif Javed has completed his PhD from Electronic Materials Research Laboratory, School of Electronic & Information Engineering, Xi'an Jiaotong University, Xi'an China. He is an Assistant Professor of Physics at University of Agriculture Faisalabad Pakistan. He has published more than 12 papers in well reputed journals. His current research interests include Advanced energy nanomaterials**,** organic–inorganic hybrid nanomaterials for solar cells, TiO_2 nanotubes/nanowires arrays, ZnO nanowires arrays and SnO_2 nanotube arrays sensitized with semiconductor quantum dots or organic dyes for photovoltaic and environmental applications.

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Session name/ number: Energy & Harvesting Materials
Category: (Oral presentation/ Poster presentation)