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SnO_2/TiO_2 nanohexagon arrays heterojunction photoanode based dye-sensitized solar cells with enhanced performance

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An efficient photoanode for dye-sensitized solar cells (DSSCs) should have several features, such as high dye uploading, favorable band gaps and good capability in electron transport. Herein, TiO_2 nanohexagon arrays (TNHAs) were fabricated by using an electrochemical anodization process. Then, the TNHAs were attached onto FTO glass for front-side illumination mode operation. The as-prepared TiO_2 nanohexagon arrays had a length of 27.25 μm and an average diameter of 125 nm. SnO_2 is a promising wide band gap material for DSSCs due to its high electron mobility. To improve the performance of DSSCs, SnO_2 was introduced into the TNHAs by using a one-step facile immersion approach in 0.25 M K_2SnO_3 solution for 30 min. The as-fabricated SnO_2/TiO_2 nanohexagon array heterojunction was utilized as the photoanode for DSSCs. The SnO_2 nanoparticles had a superior light harvesting capability owe to the higher surface area for dye uploading and the high electron mobility. The SnO_2/TNHAs heterojunction based DSSC had a power conversion efficiency of 6.34%, which was 1.32 times higher than that of the pure TiO_2 nanohexagon arrays. Furthermore, incident photon-to-current conversion efficiency (IPCE) and the amount of dye adsorption (A_{da}) are also improved, with values of 63.96% and 6.8×10^{-5} mol cm^{-2}, respectively.

Biography

Hafiz Muhammad Asif Javed has completed his PhD from Electronic Materials Research Laboratory, School of Electronic and 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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