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Performance of Dye Sensitized Solar Cells (DSSCs) based on Cu-doped TiO_2 nanostructures photoanodes.

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In this research study, Cu-doped TiO2 nanostructures with different doping contents from 0 to 10.0% (mole fraction) were synthesized through hydrolysis at low temperature. The as-prepared Cu-doped TiO2 nanostructures was characterized with several techniques, X-ray diffraction (XRD) and Raman spectroscopy were used to study the morphology and structure of the nanoparticles, which confirmed the crystalline anatase tetragonal structure. The UV-Vis Spectroscopy analysis was found that incorporation of Cu2+ into titanium affects the band gap of TiO2 and extending his activity towards visible sunlight region. Scanning Electron Microscopic (SEM) analysis confirming the Cu content is incorporated into TiO2 lattice affecting efficiency of doped samples. Further, the active specific surface area of the system was investigated employing Brunauer-Emmet-Teller (BET) measurement. Then the Dye-sensitized solar cells (DSSCs) based on Cu-doped TiO2 photoanaodes were fabricated and investigated with chemically absorbed Ruthenium N3 dye electrode under light illumination with standard solar simulator (AM 1.5G, 100mW/cm2). Results demonstrated that the 1.0% Cu-doped TiO2 sample annealed at 773K for 60 minutes exhibited the best photovoltaic performance of open circuit voltage (Voc = 957.5 mV), short circuit current density (Jsc = 0.795 mAcm-2), and the cell efficiency was reached (η = 4.524 %), which consists 50% higher than the un-doped cell. The BET analysis was supported the founding results, indicating that the 1.0% Cu-doped TiO2 nanoparticle presented the higher active specific surface area of 143.2 m2g-1. A highest active surface area is a key parameter for solar cells effectiveness, allowing more organic dye and electrolyte to be absorbed and stored into the semiconductor, that give photon from solar light energy more probability to be adsorbed which obviously led to improve global cell efficiency. This study may open up more investigated works applying Cu doped TiO2 in photovoltaic fields.

Recent Publications

1. **Desireé M. de los Santos, Sara Chahid, Rodrigo Alcántara, Javier Navas, Teresa Aguilar, Juan Jesús Gallardo, Roberto Gómez-Villarejo, Iván Carrillo-Berdugo and Concha Fernández-Lorenzo Mo/Cu/TiO2 nanoparticles: synthesis, characterization and effect on photocatalytic decomposition of methylene blue in water under visible light, DOI: 10.2166/wst.2018.101 (Publicado).**
2. **Desireé M. de los Santos, Sara Chahid, Rodrigo Alcántara, Javier Navas, Teresa Aguilar, Juan Jesús Gallardo, Antonio Sánchez-Coronilla, and Concha Fernández-Lorenzo. Mo/TiO2 mixture: A modification strategy of TiO2 nanoparticles to improve photocatalytic activity under visible light. Beilstein journal of nanotechnology, 2017 (En revisión).**
3. **Sara Chahid, Desireé M. de los Santos, Rodrigo Alcántara: The effect of Cu-doped TiO2 photoanode on photovoltaic performance of dye-sensitized solar cells. (Accepted in ACM digital library (ISBN: 978-1-4503-6562-8).**
4. **Sara Chahid, Desireé M. de los Santos, Rodrigo Alcántara, Javier Navas: Isotherm, Kinetic, and thermodynamic analysis for removal of organic pollutants Using Synthesized Mo/Cu/ co-doped TiO2 Nanostructured (sent).**

Biography

Sara Chahid has her expertise in synthesis and characterization of semiconductors, with photovoltaic and photocatalytic applications. Her open and contextual evaluation of new semiconductors based on TiO2 (Cu/ TiO2, MoS2/TiO2 and Cu-MoS2/TiO2) creates new pathways for improving renewable energy.

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