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Photovoltaic properties of dye sensitized solar cells using Cu-doped TiO₂

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Photovoltaic is a promising alternative renewable energy that utilizes sunlight energy to obtain electricity which has pronounced to solve the future energy problem faces worldwide.1, 2 Dye sensitized solar cell (DSSC) is one of leading technology in the photovoltaic field,3 due to their environmental friendliness and cost-effective alternative to silicon solar cells.4 In the present work, DSSC based on Cu-doped TiO₂ semiconductor were performed. A study about the effect of Cu on structural and optical properties of TiO₂ nanoparticles synthesized and their influence on photovoltaic properties was carried out. Methodology: Cu-doped TiO₂ samples were synthesized using a low temperature hydrolysis reaction to produced pure, 1.0% and 5.5% Cu-doped TiO₂ and annealed at 500oC.5 Doctor blade method was used to build DSSCs based on Cu-doped TiO₂ nanoparticles. The Cu-doped TiO₂ semiconductor was characterized with several tools such as XRD, ICP- AES, Raman and UV-Vis spectroscopy in order to study its physical and electronic properties. Finally, an analysis of the I-V characterization was carried out to investigate the effect of Cu-doped on DSSCs performed. Findings: Anatase TiO₂ was the predominant phase in samples under study. Electronic as well as optical properties of the pure and Cu-doped TiO₂ also were analyzed. A decrease in band gap energy for Cu-doped TiO₂ was detected. Moreover, the photovoltaic performance of the solar cells was carried out and an improvement of open circuit voltage (VOC) and the efficiency (η) of the cells based on Cu-doped TiO₂ compared with undoped TiO₂ were observed. Conclusion & significance: The obtained results may be useful to understand the influence of structural, optical and electronic properties of TiO₂ doped with Cu on their improved photovoltaic activity. Acknowledgements: We thank to the Junta de Andalucía of Spain under projects P09-FQM-04938 and ENE2014-58085-R, and FEDER funds. We gratefully acknowledge the Science and Technology Center of University of Cádiz for the supplied equipment.

Biography

Sara Chahid is a PhD student and has expertise in synthesis and characterization of doped TiO₂ nanoparticles and study of these nanomaterials in photovoltaic and photocatalytic applications.

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