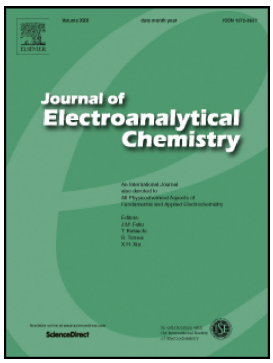

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Advantages of ZnO Nanotaper Photoanodes in Photoelectrochemical Cells and Graphene Quantum Dot Sensitized Solar Cell Applications

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Abstract

Taper-like ZnO nanorods arrays were grown on fluorine doped tin oxide (FTO) coated glass substrates by hydrothermal method. Microstructural evolutions from nanorods to nanotapes and photoelectrochemical (PEC) properties of all photoanodes were studied at various growth conditions. Nanotaper based photoanodes demonstrated superior photoconversion efficiency, higher short circuit current and minimal charge transfer resistance compared to ZnO nanorods. The PEC activities of ZnO nanotapers have been further improved after sensitization with nitrogen doped graphene quantum dots (NGQDs). The maximum photoconversion efficiency (η), short circuit current (J_{SC}) and incident photon-to-current conversion efficiency (IPCE) were achieved up to ~1.15%, ~1.04 mA/cm^2, and IPCE~~ 74.5 %, respectively, which confirmed the best PEC performance among others undoped ZnO nanostructured based photoanodes. The potential application of NGQDs sensitized nanotaper photoanodes in quantum dot sensitized solar cells has been demonstrated.

Keywords: *ZnO nanorods, ZnO nanotaper, Photoelectrochemical cell, Nitrogen doped graphene quantum dots, Quantum dot sensitized solar cells*