World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:18, No:10, 2024

The Role of Substrate-Nozzle Distance in Atomic Nebulizers in the Photoelectrochemical Water Splitting Performance of ZnO Nanorods

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Abstract : Zinc oxide (ZnO) based nanostructures are ubiquitous in applications due to their favourable physicochemical properties and ease of fabrication. One widely accessible route to synthesize ZnO nanorods, which show promising performance in e.g. photoelectrochemical water splitting, is hydrothermal growth of ZnO seeds, obtained via an atomic nebulizer. Despite its popularity, study on the impact of the synthesis parameters in atomic nebulizer on the performance of the synthesized ZnO nanostructures is lacking. This study presents an investigation on the impact of the distance between substrates and atomic nebulizer nozzle on the photoelectrochemical water splitting performance of ZnO nanorods. Adjusting such a distance reveals an optimum separation which results in nanostructures with highest absorbance. Such high absorbance translates into improved photoelectrochemistry, as evaluated by higher photocurrent density, from 0.11 mA/cm² to 0.14 mA/cm² and higher Applied Bias Photon-to-Current Efficiency (ABPE) from 0.12% to 0.14%. These results underscore the importance of understanding and optimizing the experimental parameters during ZnO nanostructure synthesis. In a broader context, it advertises the need to carefully assess the corresponding fabrication parameters to optimize the performance of the obtained nanostructures.

Keywords : atomic nebulizer, photocurrent density, photoelectrochemical water splitting, ZnO nanorods
Conference Title : ICMMSE 2024 : International Conference on Metallurgy, Materials Science and Engineering
Conference Location : Bali, Indonesia
Conference Dates : October 24-25, 2024