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Controlling the simultaneous under-potential deposition of multiple elements on TiO₂ nanotube-arrays with enhancement of photo-catalytic activity

Athil Al-Ani

University of Nottingham, UK

We report simultaneous under-potential deposition of multiple elements on TiO₂ NTAs arrays (TiO₂ NTAs) to form sensitizer of kesterite (Cu₂ZnSnS₄) to enhance the photo-conversion efficiency of the TiO₂ NTAs. The simultaneous deposition of multiple elements was successfully achieved using the modified electrochemical atomic layer deposition (EC-ALD). We controlled the electrodeposition by manipulating the concentration of the complexing agent (EDTA) and adjusting the pH value of precursor solutions. We emphasized that examine the effect of these two factors (EDTA concentration and pH value) was a key factor to assist the successful deposition of four elements onto the TiO₂ NTAs while maintaining the well-organized structure of NTAs. The electrodeposition process, surface morphology, crystalline structure and photocatalytic activity of the as-prepared and annealed Cu₂ZnSnS₄/TiO₂ NTAs were discussed. The kesterite crystalline structure of Cu₂ZnSnS₄ was successfully deposited as a single phase. In comparison with pure TiO₂ NTAs, an enhancement of 81% in the photo-conversion efficiency was observed, and the band gap was reduced from 3.1 eV to 2.43 eV using the sensitizer Cu₂ZnSnS₄. This approach probably suitable in synthesizing multijunction semiconductor materials for coating of highly structured substrates.

Biography

Athil Al-Shihabi Al-Ani is a PhD student at the University of Nottingham/Chemical and Environmental Engineering. She has finished her Master degree in Iraq at the University of Technology/Chemical Engineerin. She is a lecturar at Al-Nahrain Univesity/School of Engineering. She has published 2 papers, recently she submitted a paper to The journal of Physical Chemistry.

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