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PROGRAMME ABSTRACT

"Bridging Gaps with Creativity for Future Sustainability"

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COPPER DEPOSITED TITANIA NANOTUBES: VERSATILE PHOTOELECTRODES FOR PHOTOELECTROCHEMICAL SOLAR CELL APPLICATIONS

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Abstract

"Titanium dioxide nanotubes or known as titania nanotubes (TiNT) has unique properties such as high surface area, highly-ordered nanostructures, excellent corrosion resistance, good mechanical and chemical stability. TiNT has bright potential in various advanced technological applications including solar cells, gas sensors, water photolysis, environmental purification, bio-application and others. Nevertheless, TiNT suffers from two major drawbacks. Firstly, TiNT has a wide band gap (3.2 eV) that restricts it to only active in UV light region, which constitutes less than 5% of the solar spectrum. Secondly, rapid recombination of photogenerated electrons and holes (h⊠/e⊠) will eventually lower the quantum efficiency. A strategic approach is crucial to improve the efficiency of TiNT that is responsive towards visible light region and prolong the separation time of photogenerated electrons-holes. Selection of metal such as copper to couple with TiNT is preferable due to abundance of Cu, its non-toxicity and low fabrication cost. In this study, Cu is deposited onto TiNT forming Cu/TiNT photoanode and its photoelectrochemical (PEC) performance in solar cell application is evaluated. Firstly, anodic oxidation process was used to synthesize TiNT which served as the deposition template. Next, Cu was deposited onto TiNT using two different methods: potentiostatic and pulsed electrodeposition. Both methods allowed the manipulation of size and morphology of Cu/TiNT. FESEM analysis exhibited different Cu/TiNT morphology such as nanospherical, nanocubical, nanopyramidal and nanobipyramidal under different solution pH. Cu was noticeably resided on nanotubes thin walls by controlling the deposition potential. Improvement in PEC performance was observed for Cu/TiNT compared to bare TiNT probably ascribed to band gap narrowing and surface modification. This project demonstrates the potential of Cu/TiNT as photoanode in solar cell application.