



Enhanced photoelectrochemical efficiency of TiO₂ films with high surface energy facets by Ag nanoparticles photodeposition

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Abstract:

Surface-plasmon enhancement of the photocatalytic activity of TiO₂ onto which metal nanoparticles have been deposited has become relevant in the development of new sustainable technologies. When deposited on TiO₂ films, metallic nanoparticles can absorb visible light extending their wavelength response and boosting the creation of high energy electron-hole pairs. Among other noble metals, silver nanoparticles (Ag NPs) have attracted much attention as they represent a cheaper and biocompatible option compared with Au and Pt. In the last decade it has been found that Ag nanoparticles act as electron traps when deposited on TiO₂. This enhances the separation of charge carriers at the Ag/TiO₂ interface.

In this work, Ag NPs were photodeposited on TiO₂ films hydrothermally synthesised on FTO glass. During the hydrothermal synthesis of TiO₂, hydrofluoric acid was used as capping agent in order to induce the formation of highly misaligned polycrystalline TiO₂ with a high index of crystal boundary defects and exposed high energy facets. The photoelectrochemical (PEC) efficiencies of the Ag-TiO₂ films were then tested and compared with a highly oriented Ag-TiO₂ polycrystalline film with a negligible index of crystal boundary defects. No enhancement of the PEC activity was observed after Ag NPs deposition on highly oriented TiO₂ films, whereas the photocurrent increased by 50 % after Ag NPs were photodeposited on the TiO₂ films with a high index of crystal boundary defects. These results suggest that the deposition of Ag NPs on grain boundaries and high energy facets improves the interaction between these noble metal nanoparticles and the TiO₂ polycrystalline film.

Biographical Statement of speaker:

Mr Alfonso Ballestas received his Bachelor degree in Chemistry in 2011 at La Universidad del Zulia, Venezuela (his home country). In 2015 he received his Master degree thanks to a Fulbright Scholarship at The University of Central Florida and he is currently a PhD student at the University of Sydney supported by an Endeavour scholarship.