

Synthesis and Characterization of Silver deposited Iridium doped Titanium Dioxide Nanocomposites and their Applications in Photon Upconversion

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Abstract

Photon Up Conversion (PUC) is a physical optical phenomenon in which several low energy photons are added to get one high energy photon. This can be used to convert infrared (IR) photons into visible or ultraviolet photons. PUC stands out to be a very convenient way to harvest over 55 % of infrared radiation incident on the Earth surface for its utilization in solar energy conversion devices, such as Dye Sensitized Solar Cells (DSSCs) and water photosplitting. This research is concerned with the up conversion of infrared radiation, by developing suitable materials capable of doing so, for utilization in DSSCs and photosplitting of water to produce hydrogen gas. In this research, TiO₂ nanoparticles were doped with Iridium (III) cations to introduce the electronic energy levels within the band gap of TiO₂ using our own sol-gel/hydrothermal method to produce the specific nanostructures. Finally, silver islands were deposited on the above nanoparticles to enhance the absorbance of the material by localized plasmon resonance. This Ag-Ir(IV)-TiO₂ nanocomposite materials were characterized by XRD, UV-Visible spectroscopy, SEM, EDAX, XRF, I-V and FTIR techniques. The applications of photo water splitting and DSSCs were discussed by introducing the synthesized material.

Keywords: Water splitting, DSSC, photon up conversion, Iridium, silver, localized plasmon resonance