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EFFECT OF Au PLASMONIC NANOPARTICLES ON SHORT-CIRCUIT CURRENT DENSITY OF PbS QUANTUM DOT SENSITIZED SOLAR CELLS

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Quantum Dot-Sensitized Solar Cells (QDSSCs) have gained more attention recently in the area of solar power conversion systems due to their low production cost and the excellent properties of quantum dots such as ability of Multiple Exciton Generation (MEG), tunable energy gap due to the quantum confinement effect and high molar extinction coefficients. The working principle and structure of QDSSC is similar to the dye-sensitized solar cell. Only difference between these solar cells is the sensitizer. In dye-sensitized solar cells, organic or metal organic dyes are used as sensitizers. In the present study, TiO_2 based PbS quantum dot – sensitized solar cells were fabricated using the Successive Ionic Layer Adsorption and Reaction (SILAR) technique. In order to study the effect of Au plasmonic nanoparticles, different amounts of colloidal Au nanoparticles were incorporated into the photoanode and the amount of Au corresponding to the highest efficiency was optimized. PbS Quantum dot sensitized Au plasmonic nanoparticle incorporated solar cells show a significantly higher efficiency of 4.24% compared to the control device without Au nanoparticles. This is an efficiency enhancement of about 37.2%. Current density also shows about 35% enhancement. This is evidently due to the enhanced photocurrent caused by the Localized Surface Plasmon Resonance (LSPR) effect.

Keywords: Localized surface plasmon resonance, Plasmonic nanoparticles, Quantum dots, Tunable energy gap

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