Enhanced Photo-Conversion Efficiency of CdSe-ZnS Core-Shell Quantum Dots with Au Nanoparticles on TiO_2 Electrodes

정미희*
한국전자통신연구원
(mhjung@etri.re.kr*)

This study demonstrates that configurations that include gold nanoparticles (Au NPs) as the primary layer attached to a TiO_2 electrode with quantum dots (QDs) as the secondary layer have superior photoelectrochemical properties. We found that all Au-QDs hybrid systems reveal enhanced photocurrent generation as compared to only a QDs interface. The enhanced Jsc is attributed to sensitization that results indirectly from QDs becoming attached to Au NPs by intramolecular charge transfers. As a result of the improved performance, the overall energy conversion efficiency was increased by 100 % as compared to that of a reference cell without Au NPs at 100 mW/ cm^2. In the electrochemical impedance spectroscopy results, the intermediate frequency region of the Au-QDs cells was more significantly reduced compared to that in bare QDs cells due to the enhanced charge separation that occurs in the Au-QDs structure. Mott-Schottky (C^{-2}-ϕ) analysis shows that the lowest acceptor and donor densities having a positive effect on the efficiency could be found in QDs-Au/TiO_2 cells.