Enhanced absorption using Gold nanoparticles deposited TiO2 photoanode for dye-sensizited solar cells

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When light illuminate metal, the optical properties of nano-sized metal particles is significantly different from those of bulk metal. The modulation of optical property in nanometer-sized structures is called as a localized surface plasmon resonance(LSPR). LSPR is the collective oscillation of electrons in a solid stimulated by incident light. Once collective oscillation of electrons is induced among metal nanoparticles, the electric field of neighboring nanoparticles is strengthened and the absorption becomes strong. Therefore, metal nanopartcles are expected to have a light-harvesting effect in solar cell. As the result, the effect of LSPR contributes a current density and a cell conversion efficiency.

In this work, we have fabricated the gold nanoparticles_ deposited TiO_2 photoanode for dye-sensitized solar cell. We applied a reduction using gold precursor solution for gold nanoparticles deposition on the TiO_2 surface. Photovoltaic performances are further investigated by current-voltage characteristics, impedance spectroscopy, intensity-modulated photovoltage spectroscopy, intensity-modulated photocurrent spectroscopy and absorbance spectroscopy. We analyze light absorption behavior of dye molecules in TiO2 photoanode and the charge recombination process at the interface between TiO_2 photoanode and electrolytes.