Solar Cells with Overall Water Splitting Using Oligoaniline-Crosslinked $[Ru(bpy)_2(bpyCONHArNH_2)]^{+2}$ Dye/Iridium Oxide Nanoparticle Arrays On Three–Dimensionally Ordered Macroporous Gold-Nanoparticle Doped Titanium Dioxide (3-DMGN-TiO_2) Photonic Crystals Modified Electrodes

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This project aims the construction of photoelectrochemical cell system splitting water into hydrogen and oxygen using UV-vis light under constant applied voltage. Oligoaniline-crosslinked 2-(4-aminobenzyl)malonic acid functionalized $IrO_2.nH_2O$ [1, 2] nanoparticles and visible light absorbing dye, $[Ru(bpy)_2(bpyCONHArNH_2)^{+2}]$, arrays [3] on three–dimensionally ordered macroporous gold-nanoparticle doped titanium dioxide (3-DMGN-TiO_2) photonic crystals [4] modified electrodes will be used as (photo)anode and nanostructures based on bonding of Pt nanoparticles by using electropolimerization on poly 4-(2,5-di(thiophene-2-il)-1 H-pyrrol-1-il) benzenamin P(SNS-NH_2) conducting polymer [5] modified gold electrode will act as cathode [6]. If the system is operated under light and constant potential; water will be oxidizingly splitted by $IrO_2.nH_2O$ catalyst, and production of oxgen in anode and production of hydrogen in cathode will certainly occur. Electropolymerization of the visible region sensitive $[Ru(bpy)_2(bpyCONHArNH_2^{)+2}]$ and 2-(4-aminobenzyl)malonic acid functionalized IrO2.nH2O nanoparticles on 3-DMGN-TiO_2 films results in connection with the conductive oligoaniline bridges. The transfer of the electrons arising from the oxidation of water from nanoparticles into the valence band of $[Ru(bpy)_2(bpyCONHArNH_2)^{+2}]$ will be more faster due to the presence of conductive oligoaniline crosslinks. Within the help of these conductive crosslinks; the electron flow from $[Ru(bpy)_2(bpyCONHArNH_2)^{+2}]$ conductive band into the conductive band of TiO_2 and then into the electrode will be very fast. The doping of the TiO_2 photonic crystal film with gold nanoparticles will also enhance this fast electron transfer. Hence; this fast electron transfer will be competitive with the probable electron transfer in the reverse system or will be faster. Under these circumstances there will be an important increase in the quantum efficiency of the system.

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