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Tandem Structured Hot Electron-based Photovoltaic Cell with Double Schottky Barriers

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We show the novel hot electron based-solar energy conversion using tandem structured Schottky diode with double Schottky barriers. In this report, we show the effect of the double Schottky barriers on solar cell performance by enhancing both of internal photoemission and band-to-band excitation. The tandem structured Au/Si diode capped with TiO₂ layer as second semiconductor exhibited improved ability for light harvesting. The proposed mechanisms consist of multiple reflections of hot electrons and additional pathway of solar energy conversion due to presence of multiple interfaces between thin gold film and semiconductors. Short-circuit photocurrent measured on the tandem structured Au/Si diodes under illumination of AM1.5 increased by approximately 70% from 3.1% to 5.3% and overall incident photon to electron conversion efficiency (IPCE) was enhanced in visible light, revealing that the concept of the double Schottky barriers have significant potential as novel strategy for light harvesting.

Keywords: metal/semiconductor Schottky diode, internal photoemission, double Schottky barriers, hot electron, solar cell

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Fabrication of TiO₂ Blocking Layers for CuSCN Based Dye-Sensitized Solar Cells by Atomic Layer Deposition Method

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For enhancement of dye-sensitized solar cell performance, TiO₂ blocking layer has been used to prevent recombination between electron and hole at the conducting oxide and electrolyte interface. In solid state dye-sensitized solar cells, it is necessary to fabricate pin-hole free TiO₂ blocking layer. In this work, we deposited the TiO₂ blocking layer on conducting oxide by atomic layer deposition and compared the efficiency. To compare the efficiency, we fabricate solid state dye-sensitized solar cell with using CuSCN as hole transport material. We see the efficiency improve with 40nm TiO₂ blocking layer and the TiO₂ blocking layer morphology was characterized by SEM. Also, we used this blocking layer in TiO₂/Sb₂S₃/CuSCN solar cell.

Keywords: DSSC, Blocking layer, ALD