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Electrode formation using Light induced electroless plating in the crystalline silicon solar cells

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Screen printing is commonly used to form the electrode for crystalline silicon solar cells. However, it has caused high resistance and low aspect ratio, resulting in decrease of conversion efficiency. Accordingly, Ni/Cu/Ag plating method could be applied for crystalline silicon solar cells to reduce contact resistance. For Ni/Cu/Ag plating, laser ablation process is required to remove anti-reflection layers prior to the plating process, but laser ablation results in surface damage and then decrease of open-circuit voltage and cell efficiency. Another issue with plating process is ghost plating. Ghost plating occurred in the non-metallized region, resulting from pin-hole in anti-reflection layer. In this paper, we investigated the effect of Ni/Cu/Ag plating on the electrical properties, compared to screen printing method. In addition, phosphoric acid layer was spin-coated prior to laser ablation to minimize emitter damage by the laser. Phosphorous elements in phosphoric acid generated selective emitter throughout emitter layer during laser process. Then, KOH treatment was applied to remove surface damage by laser. At this step, amorphous silicon formed by laser ablation was recrystallized during firing process and remaining of amorphous silicon was removed by KOH treatment. As a result, electrical properties as Jsc, FF and efficiency were improved, but Voc was lower than screen printed solar cells because Voc was decreased due to surface damage by laser process. Accordingly, we expect that efficiency of solar cells could be improved by optimization of the process to remove surface damage.

Keywords: Crystalline silicon solar cell, plating, screen-printing

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Flexible quantum dot solar cells with PbS-MIx/PbS-BuDT bilayers

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Recently, in order to improve the performance of the colloidal quantum dot solar cells (CQDSCs), various efforts such as the modification of the cell architecture and surface treatment for quantum dot (QD) passivation have been made. Especially, the incorporation of halides into the QD matrix was reported to improve the performances significantly via passivating QD trap states that lower the life-time of the minority-carrier. In this work, we fabricated a lead sulfide (PbS) QD bilayer treated with different ligands and utilized it as a photoactive layer of the CQDSCs. The bottom and top PbS layer was treated using metal iodide (MI_x and butanedithiol (BuDT), respectively. All the depositions and ligand treatments were carried out in air using layer-by-layer spin-coating process. The fabrication of the active layers as well as the n-type zinc oxide (ZnO) layer was successfully carried out on the bendable indium-tin-oxide (ITO)-coated polyethylene terephthalate (PET) substrate, which implies that this technique can be applied to the fabrication of flexible and/or wearable solar cells. The power conversion efficiency (PCE) of the CQDSCs with the architecture of PET/ITO/ ZnO/PbS-MI_x/PbS-BuDT/MoO_x/Ag reached 4.2 %, which is significantly larger than that of the cells with single QD (PbS-BuDT) layer.

Keywords: Quantum Dot solar cell