

## Effect of Concentration and Remaining Time of Methyl Ammonium Iodide and Thickness of Lead Iodide on Photovoltaic Properties of Nano-structured Perovskite Solar Cells with Carbon Counter Electrode

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### Abstract

In this study, hole transport material free perovskite solar cell with carbon counter electrode was constructed and the effect of different parameters on the perovskite layer was investigated. Carbon paste with graphite particles and carbon black nanoparticles was made which is capable of being applied in the ambient temperature. The perovskite layer was applied by two-step method. The photovoltaic properties of the fabricated solar cells were determined by measuring the current-voltage curves and the electrochemical impedance spectrum. The morphology of perovskite layer was determined by atomic force microscopy. The effect of concentration of methyl ammonium iodide solution, the number of lead iodide layer deposition, the waiting time of methyl ammonium iodide solution on lead iodide layer, before spinning and the exposure of  $TiO_2$  porous layer to ethanol vapor on photovoltaic properties of resulting cells was investigated. Furthermore, the one-step and two-step methods were compared in applying the perovskite layer. It was observed that the concentration of 6 mg/ml methyl ammonium iodide, the application of one lead iodide layer, 90-seconds persistence time of methyl ammonium iodide, and exposure of sample to ethanol vapor yields the best performance of the solar cell. This yields an efficiency of 7.34 percent, which is close to that reported in literature.

**Keywords:** Perovskite solar cell, Carbon counter electrode, Hole transport material free

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