Eco-profile Analysis of Printable Perovskite Solar Cell with Carbon Counter Electrode

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Abstract

Solar cells are a promising renewable source of energy for the mitigation of global warming and the emission of greenhouse gases. Decades ago, the commercialization of silicon solar cells began, and they have become a significant player in renewable energy scenes. Life Cycle Assessment (LCA) studies done on silicon solar cells show that CO_2 emissions from their production process range from 14 to 73 g CO_2-eq/KW depending on the electricity mix used for the production. However, despite the emissions being less than those of fossil fuels they are still not negligible when considered to meet the global energy demand objectives. Perovskite solar cells are an efficient competitor for silicon solar cells, especially in terms of the carbon footprint, cost-effectiveness, and recyclability. Since the first realization of perovskite solar cells, many efforts have been taken to increase the PCE, stability, and durability. In our work, we develop a perovskite solar cell architecture with enhanced stability and competing PCE employing different HTL, such inorganic $CuInS_2$ and organic P3HT. Except for the HTL layer deposited by spin coating, the complete device stack was deposited by blade coating method out of the glovebox. To improve the eco-profile of the device, we used low-temperature printed carbon as a counter electrode instead of gold, which has a significant environmental impact. The cradle-to-gate LCA is performed based on detailed primary data of the lab scale process for the evaluation of the environmental performances of the device.

Keywords

Carbon Electrode, Life Cycle Assessment, Printable Perovskite Solar Cells, Cradle-to-Gate