

Low-Cost Perovskite Solar Cell Fabricated using the Expanded Graphite Back Contact and Electronically Conducting Activated Carbon as the Hole Transporting Material

Buddhika C. Karunarathne, Shashiprabha P. Dunuweera, Asiri T. Medagedara, Dhayalan Velauthapillai,* Ravirajan Punniamoorthy, A.G. Unil Perera, L. Ajith DeSilva, Kirthi Tennakone, Rajapakse Mudiyansele, Gamini Rajapakse, and Gamaralalage Rajanya Asoka Kumara



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ABSTRACT: Although perovskite solar cells (PSCs) have reached a record high conversion efficiency of 25.7%, the materials used to fabricate them invoke costly hole-transporting materials, such as spiro-OMeTAD, and expensive gold back contacts. The cost of fabrication of a solar cell or any other practical device is an important issue in their practical applications. In this study, we describe the fabrication of a low-cost, mesoscopic PSC, eliminating the use of expensive p-type semiconductors and substituting them with electronically conducting activated carbon, and the gold back contact with expanded graphite. The activated carbon hole transporting material was derived from readily available coconut shells and the expanded graphite from graphite attached to rock pieces of graphite vein banks. We drastically reduced the overall cell fabrication cost using these low-cost materials and added commercial value to discarded graphite and coconut shells. Under ambient conditions, our PSC gives a conversion efficiency of $8.60 \pm 0.10\%$ at 1.5 AM simulated sunlight. We have identified the lower fill factor as the limiting factor for the low conversion efficiency. We believe that the lower cost of the materials used and the deceptively simple powder pressing method would compensate for the relatively lower conversion efficiency in its practical application.

