

Fully Spray-Coated Polymer Solar Cells for Low-Cost Power Generation

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The promise of solution processed organic solar cells lies in their low-cost high-throughput manufacturability. However, this low cost aspect can only be fully realized if all of the layers are deposited by solution based, in-line compatible and large-area printable methods. Spray coating is a high-rate deposition technique characterized by the ability to deposit thin films over large areas. Here, with an automated spray coater we replaced each of the spin coated layers of a polymer solar cell. We alternatively replaced (i) the electron transport layer, a thin film of ZnO derived from sol-gel solution, (ii) the active layer, based on a poly(3-hexyl thiophene) (P3HT):(6,6)-phenyl C61-butyric acid methyl ester (PCBM) mixture, and (iii) the hole transport layer, a thin film of poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT:PSS), in a standard spin coated device with evaporated top contact yielding efficiencies around 3%, a performance which is comparable to that of the spin coated corresponding device. The film quality, deduced from atomic force microscopy and absorption measurements, confirms that spray-coated each layer can be deposited in smooth and uniform layers with characteristics comparable to spin coated films.