Application of spectral technique for accurate efficiency measurements of organic and perovskite solar cells

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As the power conversion efficiency (PCE) is a key driver of solar photovoltaics, accurate PCE measurement is of key importance. PCE of a solar cell is calculated from its current–voltage characteristic measured under illumination of standard solar spectrum (AM1.5G). However, in laboratory conditions the standard spectrum is usually simulated with noticeable deviation (Fig.1). As a result, the short-circuit current (and hence, PCE) under simulator illumination differs from that of standard illumination. In this work, we applied the spectral technique[i], which takes into account the cell spectral response and a spectral mismatch between the standard solar (AM1.5G) and the simulator spectra. As a result, we obtained the correction factor for the measured short-circuit current (Table 1).

We studied active materials for solar cells with different absorption spectra: perovskite and donor-acceptor small molecule:$PC_{71}BM$ blend (Table 1). The results showed that the spectral technique is a convenient and reliable tool to compensate the spectral mismatch between the simulator and standard solar spectra and, therefore, to evaluate the PCE under true AM1.5G in the laboratory conditions.

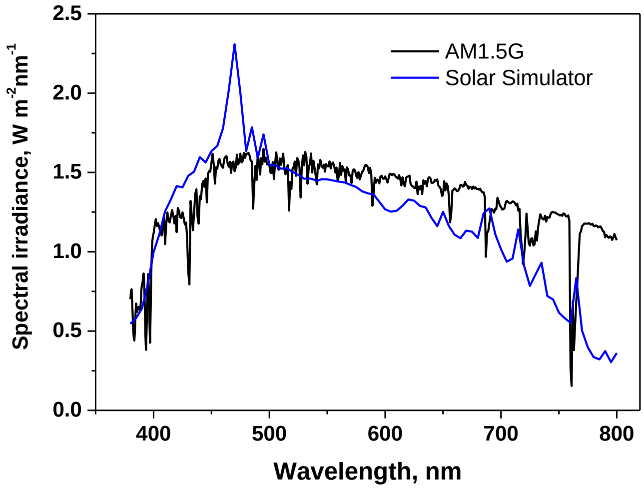

Fig. 1. Spectral irradiance of AM1.5G and Newport 67005 solar simulator spectra.

Solar cell	J_{SC}, mA/cm^2	V_{OC}, V	FF, %	PCE, %	$K = \frac{J_{ss}}{J_{AM1.5G}}$
N(Ph-2T-DCV-Et)$_3$: $PC_{71}BM$	7.25	0.96	52.1	4.13±0.16	1.02
Perovskite	13.66	1.02	65.6	9.01±0.35	1.06

Table 1. Photoelectrical characteristics of measured solar cells.

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