Supporting Information

Multiparameter investigation of bulk heterojunction organic photovoltaics

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Comparison of multiple quantities

Figure S1. Comparison of multiple quantities measured on the same area of a TQ1:PCBM blend deposited on ZnO/ITO from toluene: (a-e) height images; (f) contact potential in dark and (g) in light; (h) dark current measured at a bias of -2V applied to the ITO electrode; (i) photocurrent measured at 0V bias; (l) elastic modulus map.
**Determination of contact area**

The contact area between tip and sample was determined based on Hertz model describing the contact between a sphere and a half-space.

For small indentations the contact area is:

\[ A = 2\pi r_{tip} \left( r_{tip} - \sqrt{r_{tip}^2 - r_c^2} \right), \]

where \( r_{tip} \) is the probe radius, \( r_c \) the contact radius, and \( \left( r_{tip} - \sqrt{r_{tip}^2 - r_c^2} \right) = \frac{r_c^2}{r_{tip}} = h \) is the indentation depth.

The contact radius is:

\[ r_c = \sqrt{\frac{3F r_{tip}}{4 E^*}}, \]

being \( F \) the load force and the reduced modulus \( E^* = \left( \frac{1-v_s^2}{E_s} + \frac{1-v_{tip}^2}{E_{tip}} \right)^{-1} \), with \( v_s \) and \( v_{tip} \) the Poisson ratios and \( E_s \) and \( E_{tip} \) the elastic modulus of sample and tip, respectively.

Assuming \( E_{tip} \to \infty \) and a Poisson ratio of 0.35,\(^2\) we estimate the following contact areas corresponding to the current maps in Fig 2 and Fig 5 for applied load forces of 10 nN.

<table>
<thead>
<tr>
<th>Probe (Figure)</th>
<th>( r_{tip} )</th>
<th>( r_c )</th>
<th>( A )</th>
</tr>
</thead>
<tbody>
<tr>
<td>ElectriCont-G (Figure 2)</td>
<td>25 nm</td>
<td>5.2 nm</td>
<td>167 nm(^2)</td>
</tr>
<tr>
<td>HQ:DPE-XSC11/C (Figure 5)</td>
<td>40 nm</td>
<td>6.0 nm</td>
<td>228 nm(^2)</td>
</tr>
</tbody>
</table>

Table S1. Tip radius (\( r_{tip} \)), contact radius (\( r_c \)) and contact area (\( A \)) of the different probes used for current mapping in C- and QI-mode.

**Current density maps**

Figure S2. Current density maps (mA/cm\(^2\)) in dark (a) and upon light irradiation (b) calculated from the current maps in Figure 2, considering a tip-sample contact area of 167 nm\(^2\).
Figure S3. Current density maps (mA/cm\(^2\)) in dark (a) and upon light irradiation (b) calculated from the current maps in Figure 5, considering a tip-sample contact area of 228 nm\(^2\).

References