Supporting information

4,7-Di-2-thienyl-2,1,3-benzothiadiazole with hexylthiophene side chains and a benzodithiophene Q2 based copolymer for efficient organic solar cells

Junzhen Ren\textsuperscript{a,b}, Xichang Bao\textsuperscript{b}, Liangliang Han\textsuperscript{b}, Jiuxing Wang\textsuperscript{b}, Meng Qiu\textsuperscript{b}, Qianqian Zhu\textsuperscript{b}, Tong Hu\textsuperscript{a,b}, Ruiying Sheng\textsuperscript{a,b}, Mingliang Sun\textsuperscript{a}, Renqiang Yang\textsuperscript{b*}.

\textsuperscript{a} Institute of Material Science and Engineering, Ocean University of China, Qingdao 266100, People’s Republic of China. Fax: 86-532-66781927; Tel: 86-532-66781690; E-mail: mlsun@ouc.edu.cn

\textsuperscript{b} CAS Key Laboratory of Bio-based Materials, Qingdao Institute of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences, Qingdao 266101, People’s Republic of China. Fax: 86-532-80662778; Tel: 86-532-80662700; E-mail: yangrq@qibebt.ac.cn

\textsuperscript{‡} J. Ren and X. Bao contributed equally to this work.
Figure S1. The absorption coefficient of PBDT-DTTBT in the CHCl$_3$ solution (a) and thin solid film (b).
Table S1 Photovoltaic properties of the PSCs based on the blend of PBDT-DTTBT and PC_{71}BM

<table>
<thead>
<tr>
<th>Ratio (A : D, w/w)</th>
<th>DIO (%)</th>
<th>$V_{oc}$ (V)</th>
<th>$J_{sc}$ (mA/cm²)</th>
<th>FF (%)</th>
<th>PCE$<em>{max}$/PCE$</em>{ave}$$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 : 1</td>
<td>2</td>
<td>0.81±0.01</td>
<td>10.64±0.04</td>
<td>57.53±0.16</td>
<td>4.97/ (4.96±0.01)</td>
</tr>
<tr>
<td>1 : 1</td>
<td>2</td>
<td>0.80±0.01</td>
<td>12.56±0.22</td>
<td>60.38±0.70</td>
<td>6.19/ (6.05±0.16)</td>
</tr>
<tr>
<td>1 : 1.5</td>
<td>2</td>
<td>0.80±0.01</td>
<td>9.99±0.10</td>
<td>62.82±0.23</td>
<td>4.93/ (4.87±0.07)</td>
</tr>
<tr>
<td>1 : 2</td>
<td>2</td>
<td>0.79±0.01</td>
<td>9.68±0.17</td>
<td>62.14±1.04</td>
<td>4.91/ (4.78±0.12)</td>
</tr>
</tbody>
</table>

$^a$The average PCE was obtained from five devices.

Figure S2. $J$-$V$ curves of the PSCs based on PBDT-DTTBT and PC$_{71}$BM with different D/A ratios.
Figure S3. The molecular structures of PBDT-DTBT, PBDT-TBT-C8, P(BDT-TT-BT), P(BDT-TT-BT), PBDT_HDO-DT_HBTff and PBDTDTBT.
Figure S4. XRD pattern of PBDT-DTTBT as film
Figure S5. $^1$H NMR spectrum of compound 4.
Figure S6. $^1$H NMR spectrum of DTTBT.
Figure S7. $^{13}$C NMR spectrum of DTTBT.
Figure S8. $^1$H NMR spectrum of PBDT-DTTBT.