Electronic Supplementary Information (ESI)

Novel conjugated polymers based on bis-dithieno[3,2-b;2',3'-d]pyrrole vinylene donor and diketopyrrolopyrrole acceptor: side chain engineering in organic field effect transistors

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S1

**Fig. S1** $^1$H NMR Spectra of B(C$_{12}$-DTP)V
Fig. S2 $^{13}$C NMR Spectra of B(C$_{12}$-DTP)V
Fig. S3 Mass Spectra of B(C_{12}-DTP)V
2. Characterization of PB(C_{12}DTP)V-DTDPP-C_{12} and PB(C_{12} DTP)V-DTDPP-C_{12}C_{8}.

2.1 Thermalgravimetric Analysis (TGA)

![Thermalgravimetric Analysis](image)

**Fig. S4** Thermogravimetric analysis of PB(C_{12}DTP)V-DTDPP-C_{12} and PB(C_{12}DTP)V-DTDPP-C_{12}C_{8} at a ramping rate of 10 °C min^{-1}.
2.2 Differential Scanning Calorimetry (DSC)

**Fig. S5** DSC thermograms of PB(C_{12}DTP)V-DTDPP-C_{12} and PB(C_{12}DTP)V-DTDPP-C_{12}C_{8} polymers.
2.3 AFM analysis

Fig. S6 Tapping-mode AFM phase images of (a, b) PB(C_{12}DTP)V-DTDPP-C_{12} film after annealing at 220 °C and (c, d) PB(C_{12}DTP)V-DTDPP-C_{12}C_8 film after annealing at 180 °C. Thin film was fabricated by 1,2-dichlorobenzene with spin rate 2000 rpm.
Fig. S7 Tapping-mode AFM height images of (a, b) PB(C$_{12}$DTP)V-DTDPP-C$_{12}$ film after annealing at 220 °C and (c, d) PB(C$_{12}$DTP)V-DTDPP-C$_{12}$C$_8$ film after annealing at 180 °C. PB(C$_{12}$DTP)V-DTDPP-C$_{12}$ film was fabricated by (a) chlorobenzene with spin rate 2500 rpm ($R_t = 2.49$ nm), and (b) 1,2-dichlorobenzene with spin rate 1500 rpm ($R_t = 4.17$ nm). PB(C$_{12}$DTP)V-DTDPP-C$_{12}$C$_8$ film was fabricated by (c) chlorobenzene with spin rate 2500 rpm ($R_t = 1.64$ nm), and (d) 1,2-dichlorobenzene with spin rate 1500 rpm ($R_t = 2.66$ nm).
2.4 GIXD measurements

Fig. S8 2D GIXD pattern of (a) the OCSC PB(C_{12}DTP)V-DTDP-C_{12}, (b) the OCSC PB(C_{12}DTP)V-DTDP-C_{12}C_8, (c) the spin-coated PB(C_{12}DTP)V-DTDP-C_{12} and (d) the spin-coated PB(C_{12}DTP)V-DTDP-C_{12}C_8 films.

Fig. S9 In-plane profiles (dot) and Gaussian fitting peaks (color lines), (a) for the OCSC PB(C_{12}DTP)V-DTDP-C_{12}, and (b) for the OCSC PB(C_{12}DTP)V-DTDP-C_{12}C_8 films.
2.5 OTFT device performances

**Table S1.** Off-centre spin coated OTFT device performances for B(DTP)V-DTDPP polymers measured under nitrogen

<table>
<thead>
<tr>
<th>Polymers</th>
<th>Solvent</th>
<th>Spin rate (rpm)</th>
<th>Coating direction</th>
<th>$T_a$ ($^\circ$C)$^a$</th>
<th>$\mu_{h, adv}$ ($\mu_{h, max}$) (cm$^2$V$^{-1}$s$^{-1}$)$^b$</th>
<th>$V_{th}$ (V)</th>
<th>$I_{on}/I_{off}$</th>
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</thead>
<tbody>
<tr>
<td>PB(DTP)V-DTDPP-C$_{12}$</td>
<td>ODCB</td>
<td>2000</td>
<td>parallel</td>
<td>RT</td>
<td>0.073 (0.086)</td>
<td>-22</td>
<td>10$^{1}$-10$^{2}$</td>
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<tr>
<td></td>
<td>ODCB</td>
<td>2000</td>
<td>parallel</td>
<td>50</td>
<td>0.092 (0.10)</td>
<td>-24</td>
<td>10$^{1}$-10$^{2}$</td>
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<tr>
<td></td>
<td>ODCB</td>
<td>2000</td>
<td>parallel</td>
<td>240</td>
<td>0.008 (0.011)</td>
<td>-22</td>
<td>10$^{1}$-10$^{2}$</td>
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<tr>
<td></td>
<td>ODCB</td>
<td>1500</td>
<td>parallel</td>
<td>220</td>
<td>0.091 (0.16)</td>
<td>-12</td>
<td>10$^{1}$-10$^{2}$</td>
</tr>
<tr>
<td></td>
<td>CB</td>
<td>2500</td>
<td>parallel</td>
<td>220</td>
<td>0.13 (0.19)</td>
<td>-29</td>
<td>10$^{1}$-10$^{2}$</td>
</tr>
<tr>
<td></td>
<td>CB</td>
<td>2000</td>
<td>parallel</td>
<td>220</td>
<td>0.051 (0.064)</td>
<td>-15</td>
<td>10$^{1}$-10$^{2}$</td>
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<tr>
<td></td>
<td>ODCB</td>
<td>2000</td>
<td>parallel</td>
<td>RT</td>
<td>0.098 (0.11)</td>
<td>-18</td>
<td>10$^{1}$-10$^{2}$</td>
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<tr>
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<td>ODCB</td>
<td>2000</td>
<td>parallel</td>
<td>50</td>
<td>0.13 (0.26)</td>
<td>-25</td>
<td>10$^{1}$-10$^{2}$</td>
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<tr>
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<td>ODCB</td>
<td>1500</td>
<td>parallel</td>
<td>180</td>
<td>0.55 (0.78)</td>
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<td>10$^{1}$-10$^{2}$</td>
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<td>CB</td>
<td>2500</td>
<td>parallel</td>
<td>180</td>
<td>0.18 (0.24)</td>
<td>-20</td>
<td>10$^{1}$-10$^{2}$</td>
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<tr>
<td></td>
<td>CB</td>
<td>2000</td>
<td>parallel</td>
<td>180</td>
<td>0.062 (0.083)</td>
<td>-32</td>
<td>10$^{1}$-10$^{2}$</td>
</tr>
</tbody>
</table>

$^a$Ta indicates annealing temperature. $^b$Average mobilities and maximum values of hole mobility are shown in parentheses (more than 20 devices were tested for each polymer). $^c$Averaged value of 20 devices. ODCB and CB indicate 1,2-dichlorobenzene and chlorobenzene, respectively.