Supporting Information

Antisolvent-assisted Controllable Growth of Fullerene Single Crystal Microwires for Organic Field Effect Transistors and Photodetectors

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† X. Zhao and T. Liu have the equivalent contribution
Figure S1 X-Ray photoelectron spectroscopy (XPS) C1s spectrum of as-prepared C$_{60}$ single crystals.
Figure S2  Representative optical microscopy images of C$_{60}$ microwires prepared under (a) C$_{C60}$ =2.0 mg mL$^{-1}$; (b) C$_{C60}$ =1.0 mg mL$^{-1}$; (c) C$_{C60}$ =0.5 mg mL$^{-1}$; (d) C$_{C60}$ =0.2 mg mL$^{-1}$ with IPA as antisolvent.
Figure S3 Representative optical microscopy images of C$_{60}$ microwires prepared under (a) C$_{C_{60}}$ =2.0 mg mL$^{-1}$; (b) C$_{C_{60}}$ =1.0 mg mL$^{-1}$; (c) C$_{C_{60}}$ =0.5 mg mL$^{-1}$; (d) C$_{C_{60}}$ =0.2 mg mL$^{-1}$ with EtOH as antisolvent.
Figure S4 Representative optical microscopy images of C$_{60}$ microwires prepared under (a) C$_{C_{60}}$ = 2.0 mg mL$^{-1}$; (b) C$_{C_{60}}$ = 1.0 mg mL$^{-1}$; (c) C$_{C_{60}}$ = 0.5 mg mL$^{-1}$; (d) C$_{C_{60}}$ = 0.2 mg mL$^{-1}$ with MeOH as antisolvent.
Figure S5 Representative scanning electron microscopy images of C$_{60}$ microwires prepared under (a) C$_{C60}$ = 2.0 mg mL$^{-1}$; (b) C$_{C60}$ = 1.0 mg mL$^{-1}$; (c) C$_{C60}$ = 0.5 mg mL$^{-1}$; (d) C$_{C60}$ = 0.2 mg mL$^{-1}$ with IPA as antisolvent.
Figure S6 Representative scanning electron microscopy images of C$_{60}$ microwires prepared under (a) C$_{C_{60}}$$=$2.0 mg mL$^{-1}$; (b) C$_{C_{60}}$$=$1.0 mg mL$^{-1}$; (c) C$_{C_{60}}$$=$0.5 mg mL$^{-1}$; (d) C$_{C_{60}}$$=$0.2 mg mL$^{-1}$ with EtOH as antisolvent.
Figure S7 Representative scanning electron microscopy images of C\textsubscript{60} microwires prepared under (a) C\textsubscript{C60} =2.0 mg mL\textsuperscript{-1}; (b) C\textsubscript{C60} =1.0 mg mL\textsuperscript{-1}; (c) C\textsubscript{C60} =0.5 mg mL\textsuperscript{-1}; (d) C\textsubscript{C60} = 0.2 mg mL\textsuperscript{-1} with MeOH as antisolvent.
Figure S8 Representative AFM selected area roughness analysis images of C$_{60}$ microwires prepared under (a) C$_{C_{60}}$ = 2.0 mg mL$^{-1}$; (b) C$_{C_{60}}$ = 1.0 mg mL$^{-1}$; (c) C$_{C_{60}}$ = 0.5 mg mL$^{-1}$; (d) C$_{C_{60}}$ = 0.2 mg mL$^{-1}$ with IPA as antisolvent.
Figure S9: Representative AFM selected area roughness analysis images of C$_{60}$ (a) (b) (c) (d)
microwires prepared under (a) $C_{C_60} = 2.0 \text{ mg mL}^{-1}$; (b) $C_{C_60} = 1.0 \text{ mg mL}^{-1}$; (c) $C_{C_60} = 0.5 \text{ mg mL}^{-1}$; (d) $C_{C_60} = 0.2 \text{ mg mL}^{-1}$ with EtOH as antisolvent.
Figure S10 Representative AFM selected area roughness analysis images of C$_{60}$ microwires prepared under (a) C$_{C60}$ = 2.0 mg mL$^{-1}$; (b) C$_{C60}$ = 1.0 mg mL$^{-1}$; (c) C$_{C60}$ = 0.5 mg mL$^{-1}$; (d) C$_{C60}$ = 0.2 mg mL$^{-1}$ with MeOH as antisolvent.
Figure S11 XRD patterns of vacuum-annealed FCC C$_{60}$ single crystals grown by AVD method applying different antisolvents.
Figure S12. SAED patterns of vacuum-annealed FCC \( C_{60} \) single crystals grown by AVD method with (a) IPA, (b) EtOH and (c) MeOH as antisolvent, respectively.
Figure S13 Representative transfer characteristics of the OFETs based on C$_{60}$ crystal microwires grown from a xylene solution with a concentration of (a) 2.0 mg mL$^{-1}$; (b) 1.0 mg mL$^{-1}$; (c) 0.5 mg mL$^{-1}$; (d) 0.2 mg mL$^{-1}$ with IPA as antisolvent.
Figure S14  Representative transfer
characteristics of the OFETs based on C$_{60}$ crystal microwires grown from a xylene solution with a concentration of (a) 2.0 mg mL$^{-1}$; (b) 1.0 mg mL$^{-1}$; (c) 0.5 mg mL$^{-1}$; (d) 0.2 mg mL$^{-1}$ with EtOH as antisolvent.
Figure S15: Representative transfer characteristics of the OFETs based on C$_{60}$ crystal.

(a) $\mu = 0.56 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$, $I_{on} / I_{off} = 1.3 \times 10^4$, $V_T = 15.1 \text{ V}$

(b) $\mu = 0.48 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$, $I_{on} / I_{off} = 1.6 \times 10^4$, $V_T = 14.3 \text{ V}$

(c) $\mu = 0.39 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$, $I_{on} / I_{off} = 1.4 \times 10^4$, $V_T = 11.6 \text{ V}$

(d) $\mu = 0.27 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$, $I_{on} / I_{off} = 1.1 \times 10^4$, $V_T = 13.5 \text{ V}$
microwires grown from a xylene solution with a concentration of (a) 2.0 mg mL\(^{-1}\); (b) 1.0 mg mL\(^{-1}\); (c) 0.5 mg mL\(^{-1}\); (d) 0.2 mg mL\(^{-1}\) with MeOH as antisolvent.
Figure S16 Typical transfer characteristics of OFETs based on C$_{60}$ needle crystals grown from drop cast method with a concentration of 0.5 mg mL$^{-1}$. 
Figure S17 Spectral responsivity of the AVD photodetector measured as a function of illumination wavelength at an applied bias of 30 V.
Figure S18 Normalized responsivity of the ACD photodetectors and DC photodetectors in ambient environment without encapsulation as a function of storage time. The temperature and relative humidity is 23 °C and 30%.
Table S1 Characteristics of AVD photodetectors based on C₆₀ SCMWs with different surface-to-volume ratio. Photo-response was measured at a fixed voltage of 30 V with power density of 1.5 mW cm⁻²

<table>
<thead>
<tr>
<th>Antisolvent</th>
<th>C₆₀ (mg mL⁻¹)</th>
<th>Surface-to-volume ratio</th>
<th>On/off ratio</th>
<th>Responsivity (A W⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPA</td>
<td>2.0</td>
<td>~ 6268</td>
<td>26.7</td>
<td>82.6</td>
</tr>
<tr>
<td>EtOH</td>
<td>2.0</td>
<td>~ 4157</td>
<td>15.8</td>
<td>50.3</td>
</tr>
<tr>
<td>MeOH</td>
<td>2.0</td>
<td>~ 3894</td>
<td>13.3</td>
<td>12.9</td>
</tr>
</tbody>
</table>