Electronic Supplementary Material (ESI) for Nanoscale.

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

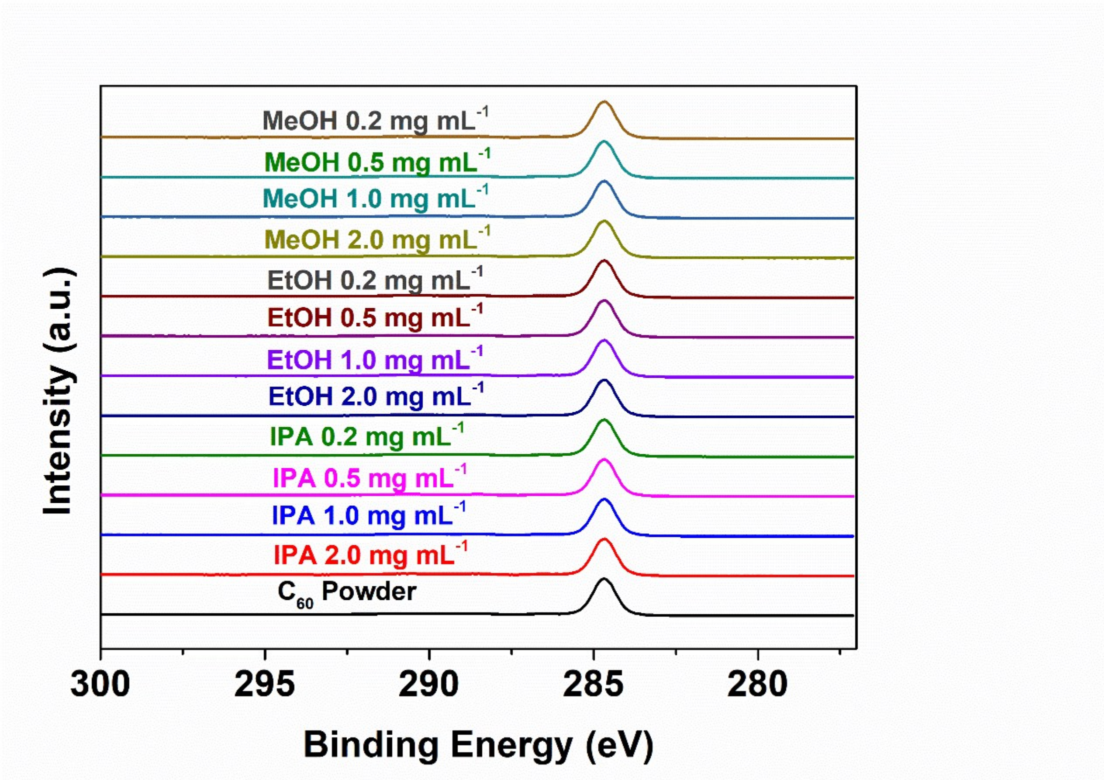


Figure S1 X-Ray photoelectron spectroscopy (XPS) C1s spectrum of as-prepared C_{60} single crystals.

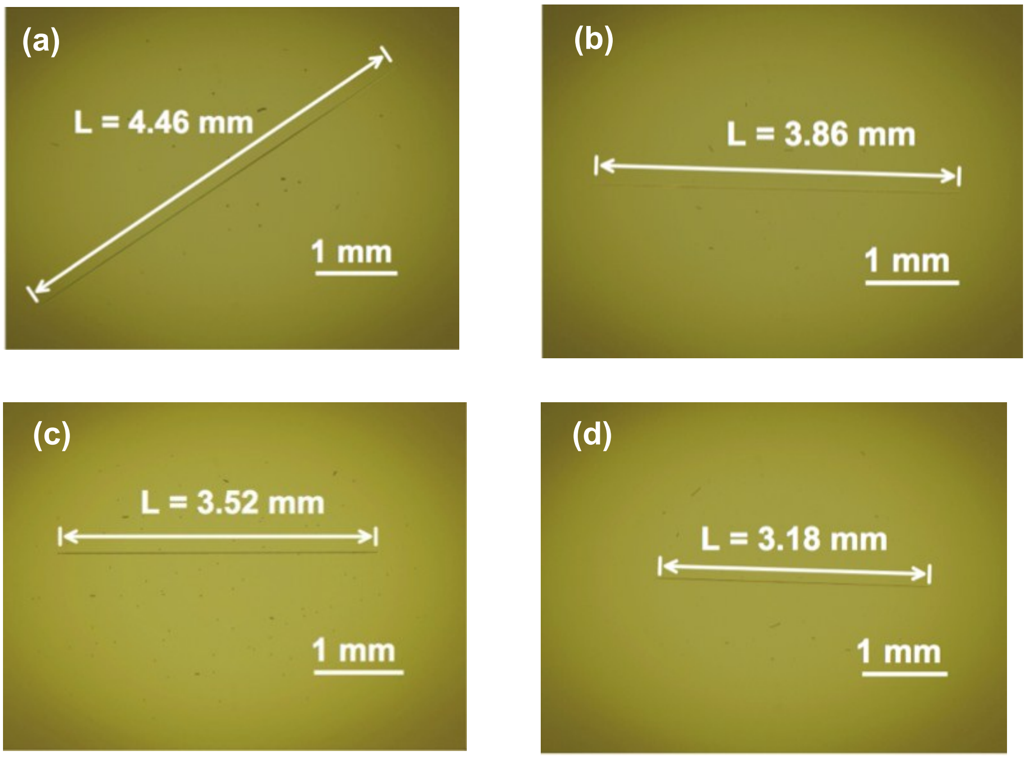


Figure S2 Representative optical microscopy images of C_{60} microwires prepared under (a) C_{C60} =2.0 mg mL^{-1}; (b) C_{C60} =1.0 mg mL^{-1}; (c) C_{C60} =0.5 mg mL^{-1}; (d) C_{C60} =0.2 mg mL^{-1} with IPA as antisolvent.

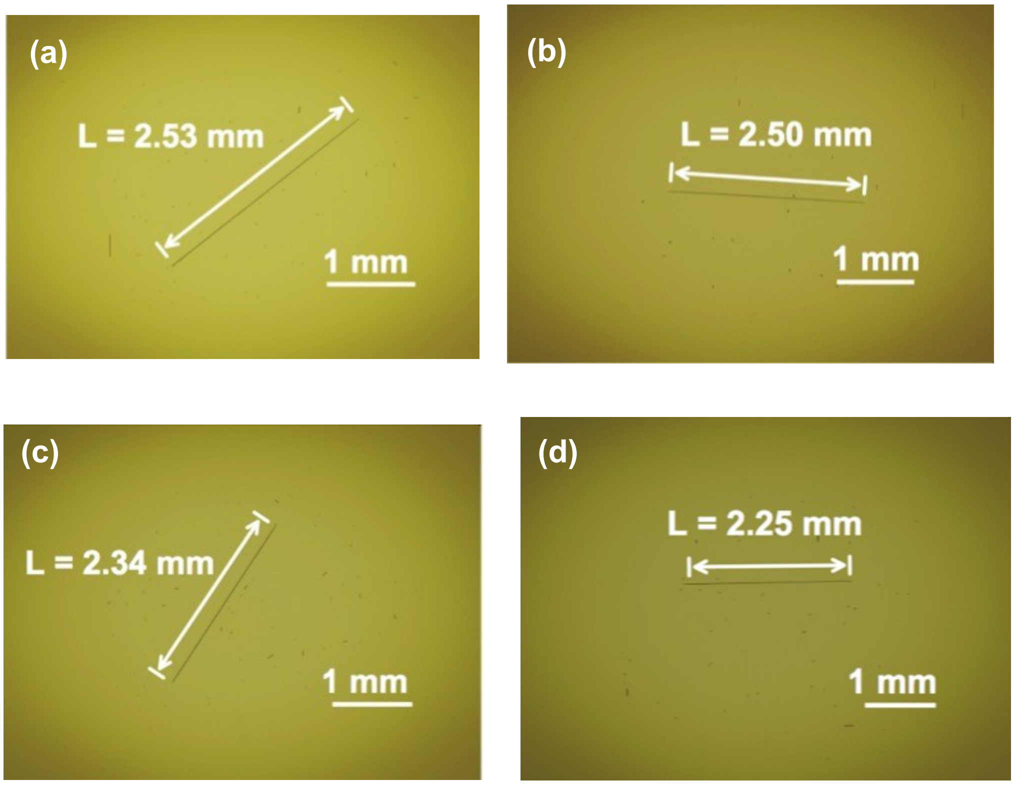


Figure S3 Representative optical microscopy images of C_{60} microwires prepared under (a) C_{C60} =2.0 mg mL^{-1}; (b) C_{C60} =1.0 mg mL^{-1}; (c) C_{C60} =0.5 mg mL^{-1}; (d) C_{C60} =0.2 mg mL^{-1} with EtOH as antisolvent.

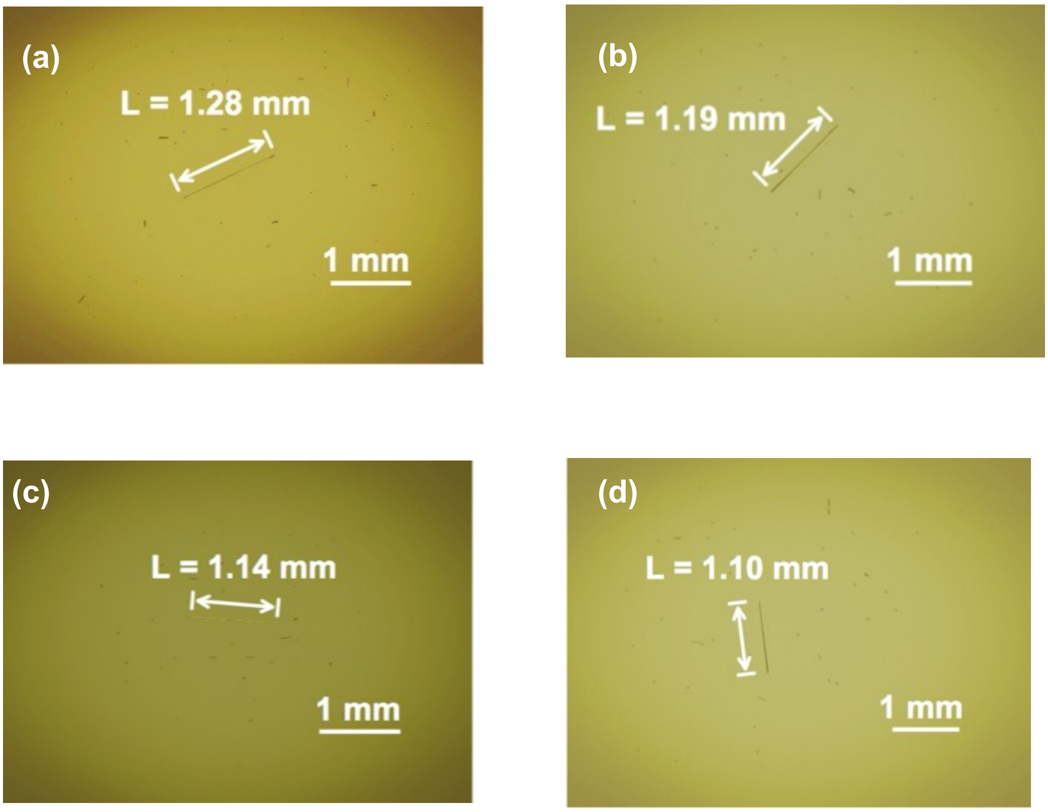


Figure S4 Representative optical microscopy images of C_{60} microwires prepared under (a) C_{C60} =2.0 mg mL^{-1}; (b) C_{C60} =1.0 mg mL^{-1}; (c) C_{C60} =0.5 mg mL^{-1}; (d) C_{C60} =0.2 mg mL^{-1} with MeOH as antisolvent.

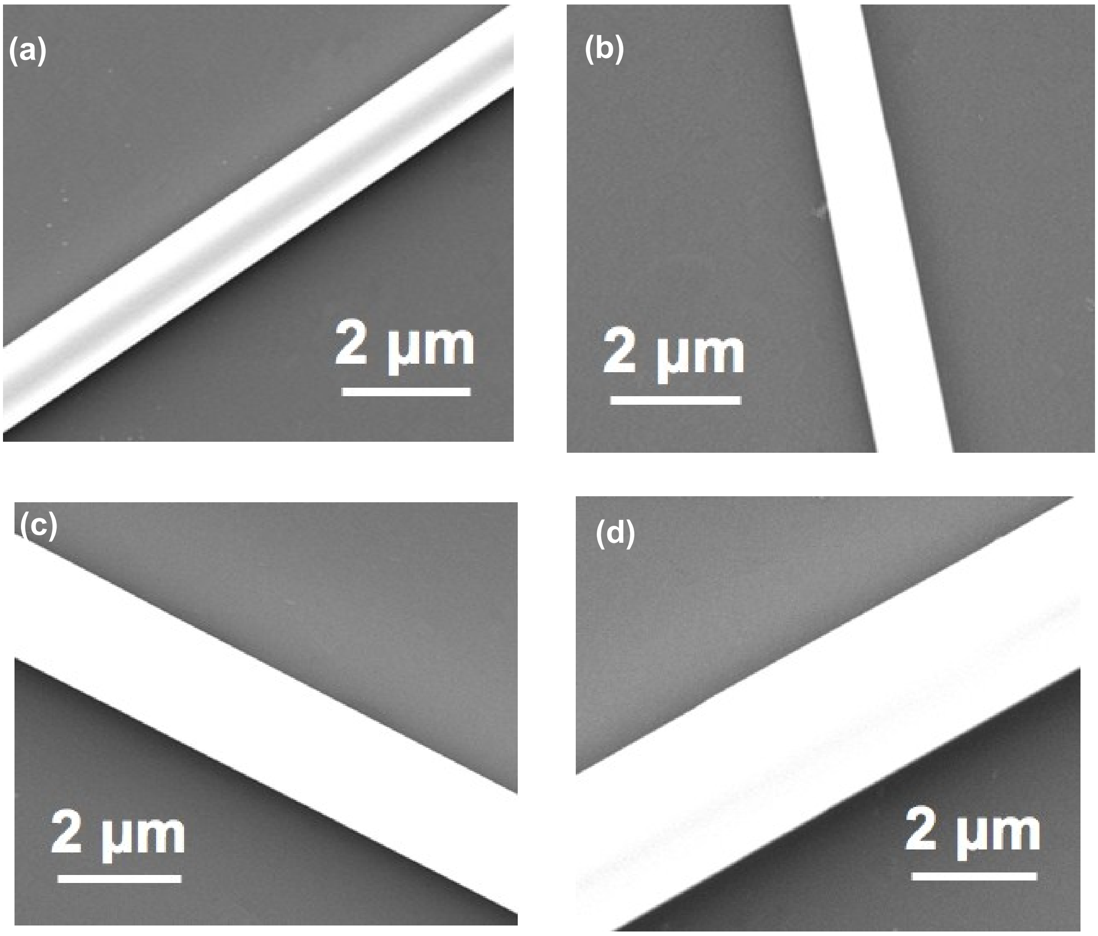


Figure S5 Representative scanning electron microscopy images of C_{60} microwires prepared under (a) C_{C60} =2.0 mg mL^{-1}; (b) C_{C60} =1.0 mg mL^{-1}; (c) C_{C60} =0.5 mg mL^{-1}; (d) C_{C60} = 0.2 mg mL^{-1} with IPA as antisolvent.

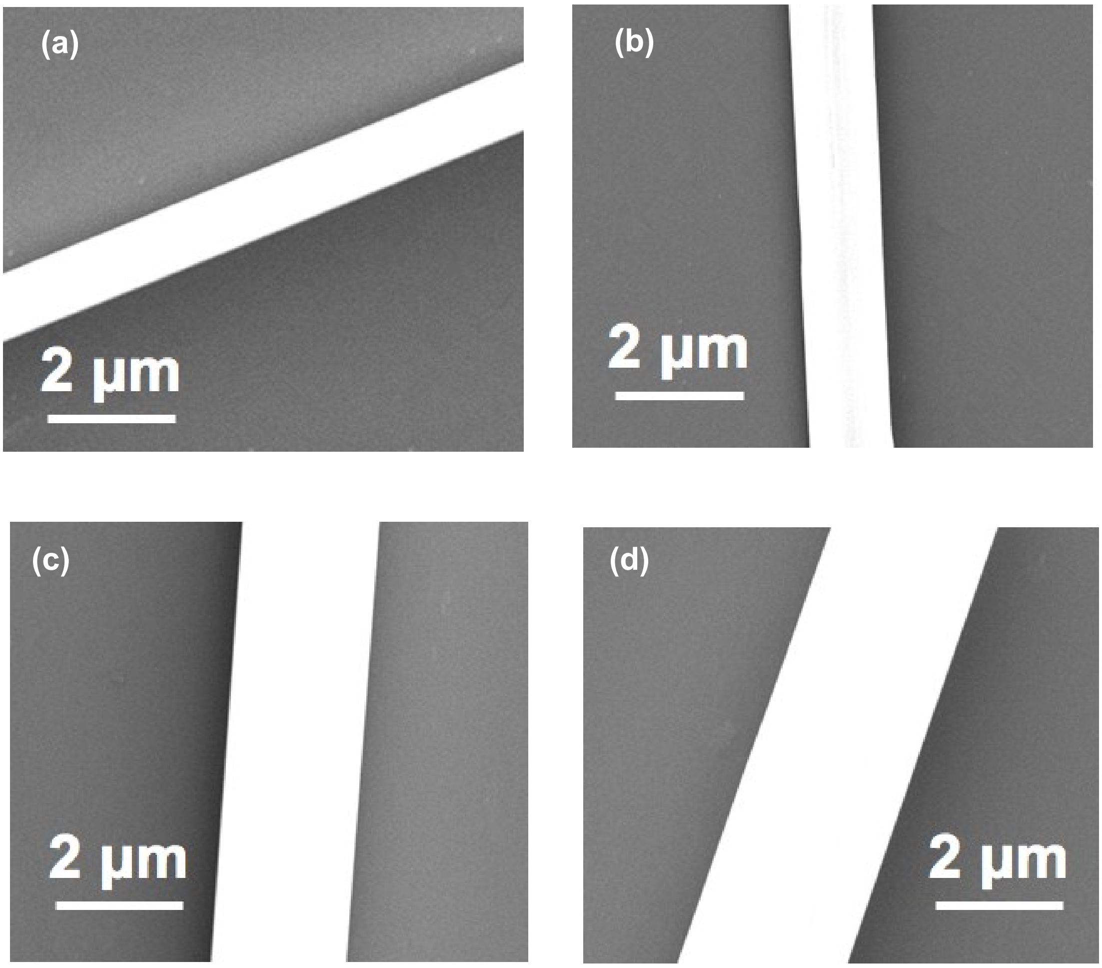


Figure S6 Representative scanning electron microscopy images of C_{60} microwires prepared under (a) C_{C60} =2.0 mg mL^{-1}; (b) C_{C60} =1.0 mg mL^{-1}; (c) C_{C60} =0.5 mg mL^{-1}; (d) C_{C60} = 0.2 mg mL^{-1} with EtOH as antisolvent.

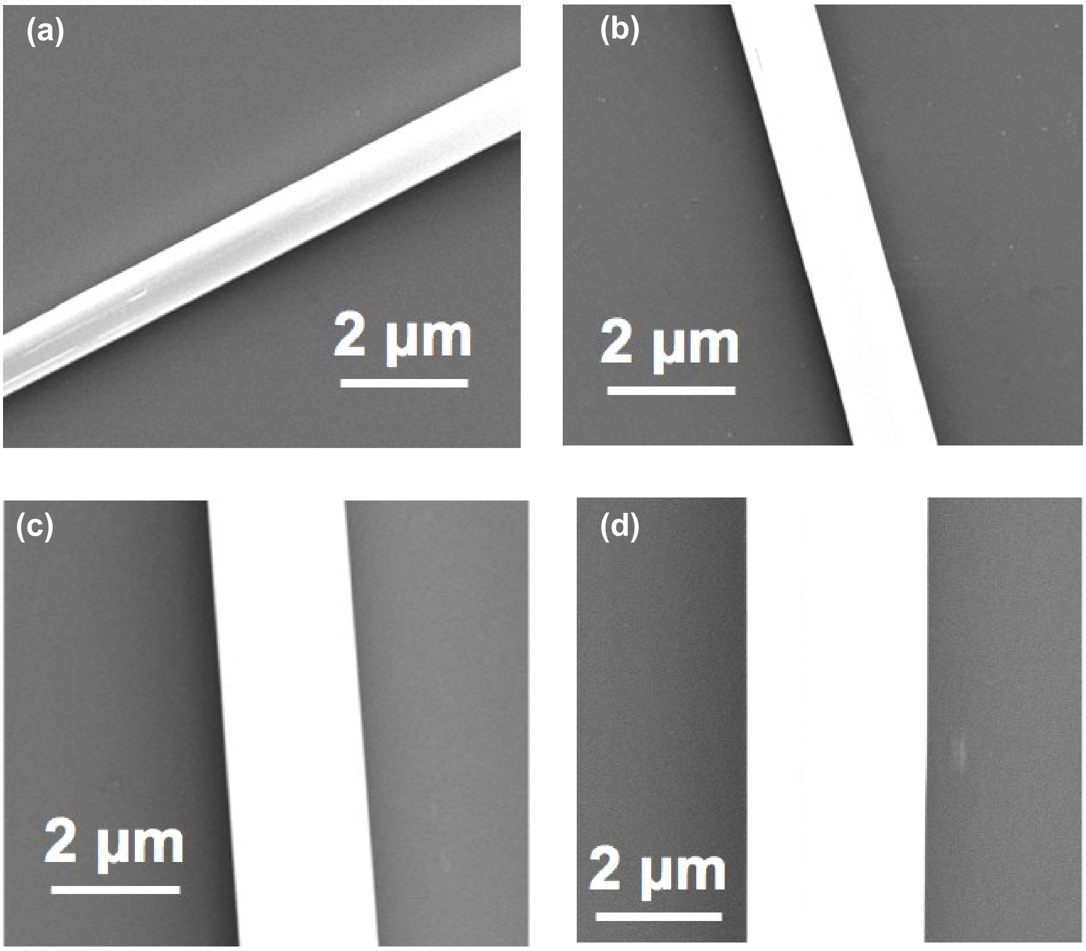

(a)
2 μm
(b)
2 μm
(c)
2 μm
(d)
2 μm

Figure S7 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 MeOH as antisolvent.

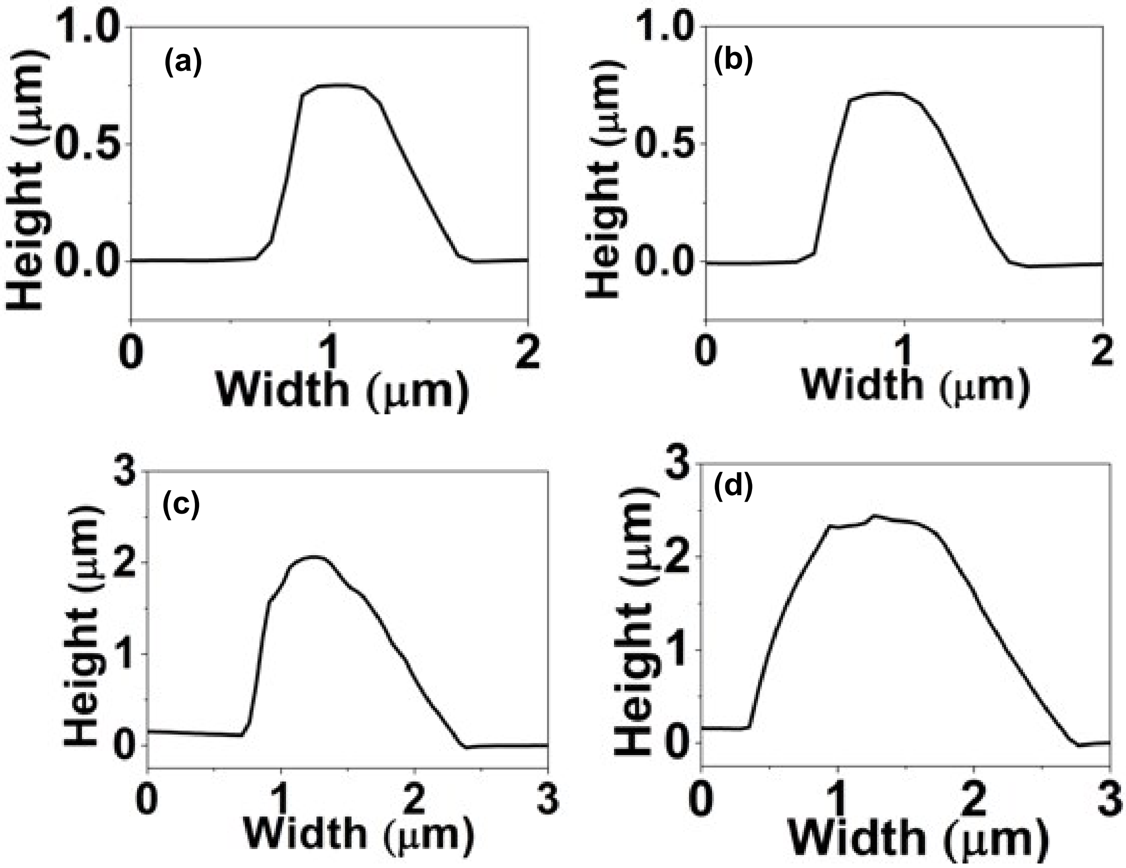
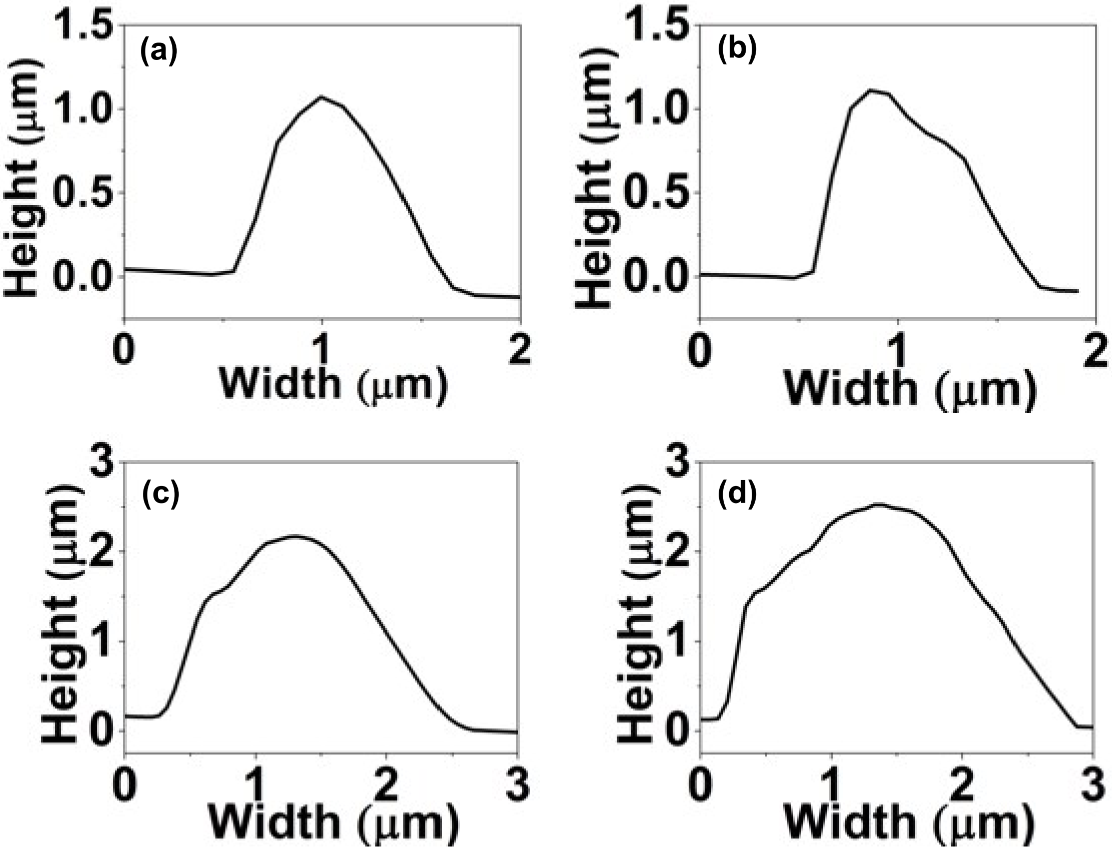


Figure S8 Representative AFM selected area roughness analysis images of C_{60} microwires prepared under (a) C_{C60} = 2.0 mg mL^{-1}; (b) C_{C60} = 1.0 mg mL^{-1}; (c) C_{C60} = 0.5 mg mL^{-1}; (d) C_{C60} = 0.2 mg mL^{-1} with IPA as antisolvent.



(a)
(b)
(c)
(d)
Height (μm)
Width (μm)
1.5
1.0
0.5
0.0
0
1
2
3

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 EtOH as antisolvent.

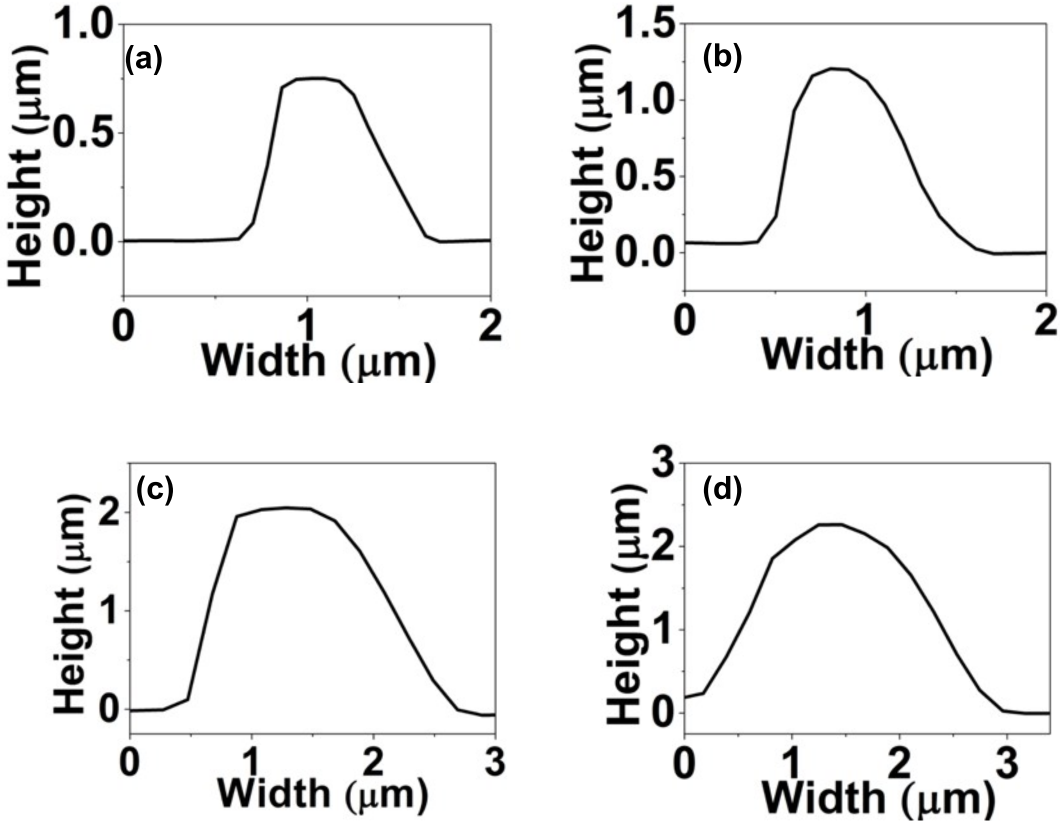


Figure S10 Representative AFM selected area roughness analysis images of C_{60} microwires prepared under (a) C_{C60} = 2.0 mg mL^{-1}; (b) C_{C60} = 1.0 mg mL^{-1}; (c) C_{C60} = 0.5 mg mL^{-1}; (d) C_{C60} = 0.2 mg mL^{-1} with MeOH as antisolvent.

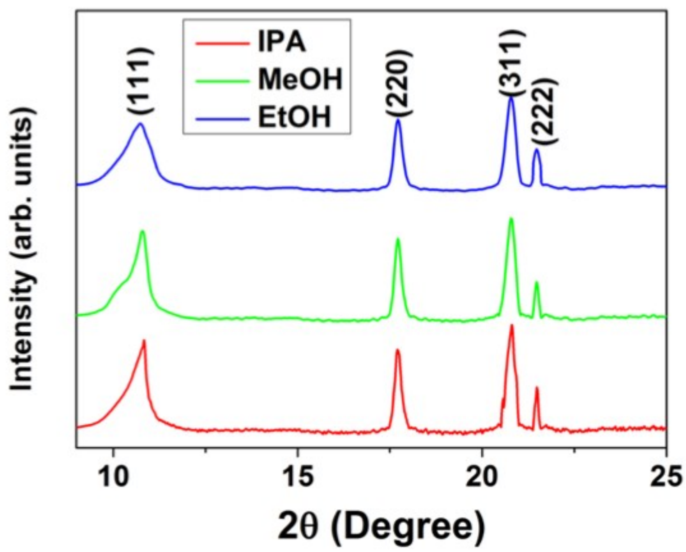
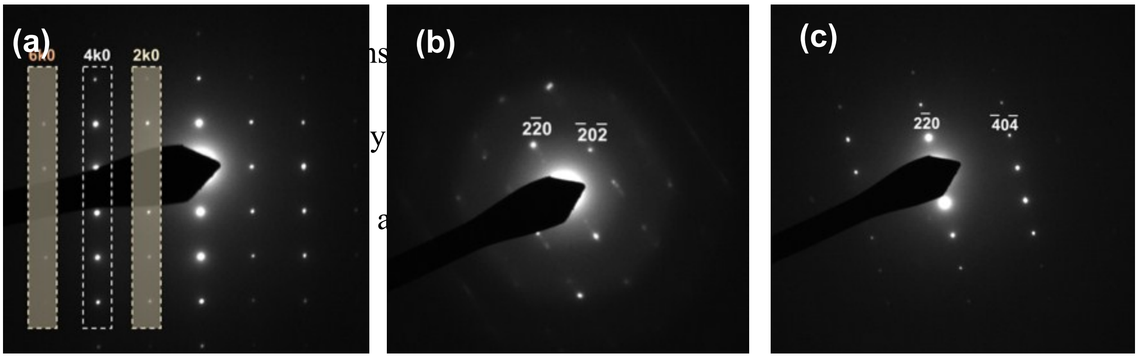


Figure S11 XRD patterns of vacuum-annealed FCC C_{60} single crystals grown by AVD method applying different antisolvents.


(a)
6k0
4k0
2k0
(b)
$2\bar{2}0$
$\bar{2}0\bar{2}$
(c)
$2\bar{2}0$
$\bar{4}0\bar{4}$

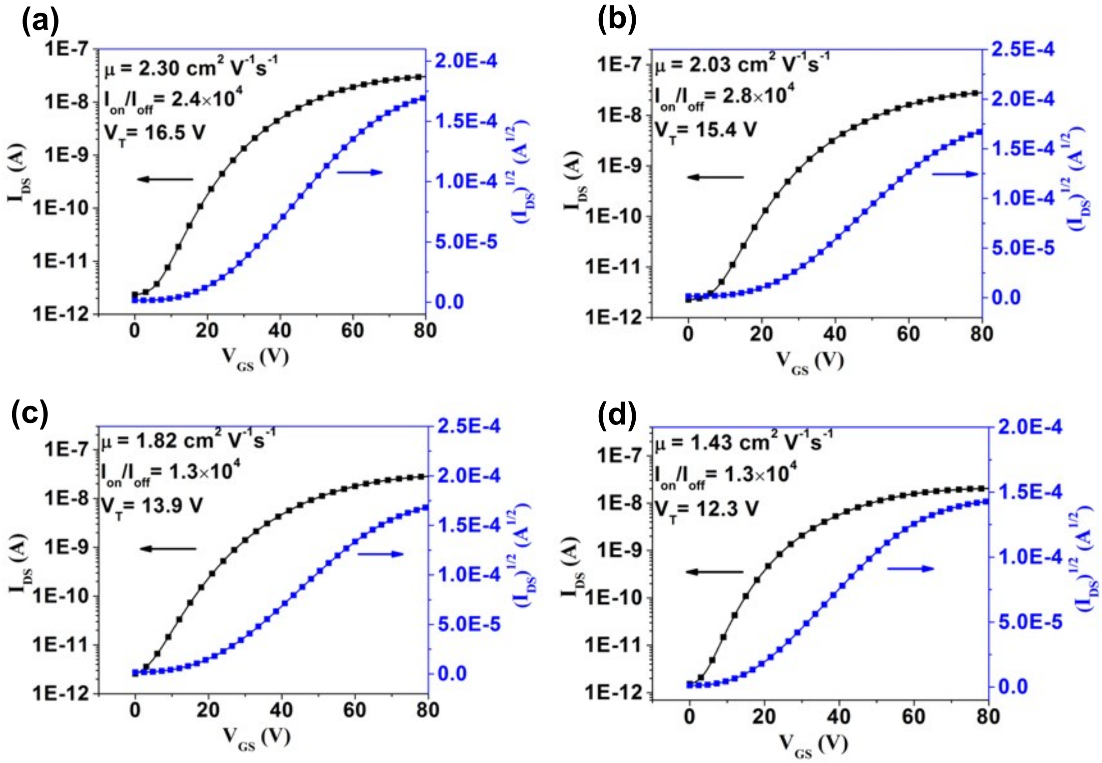
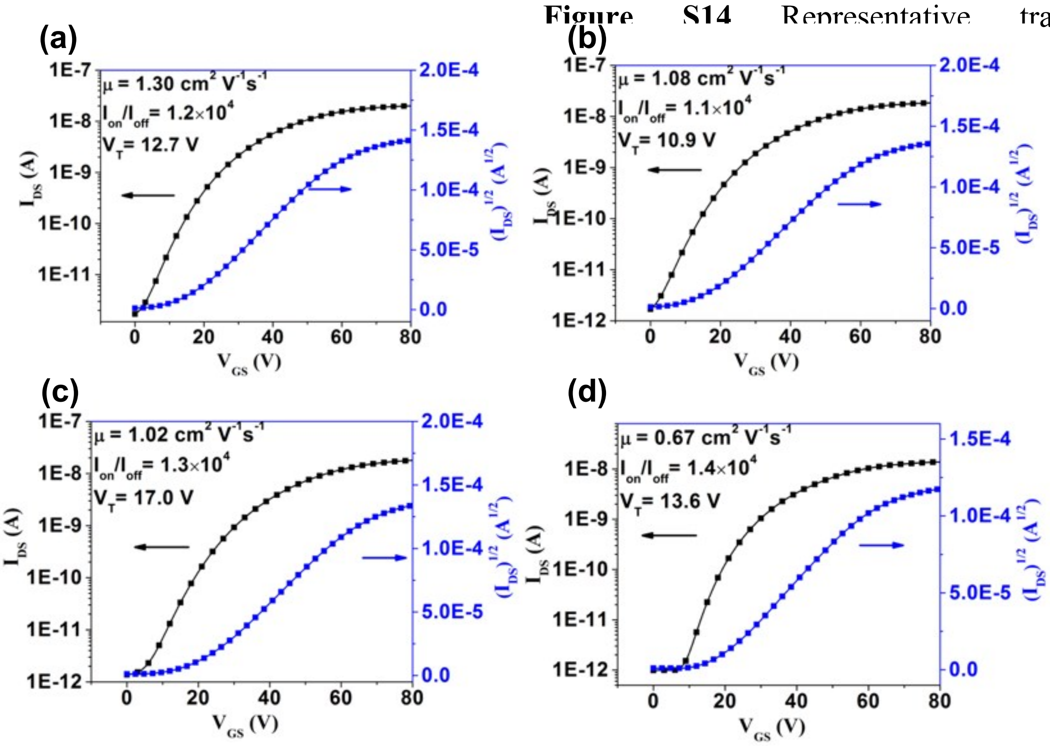
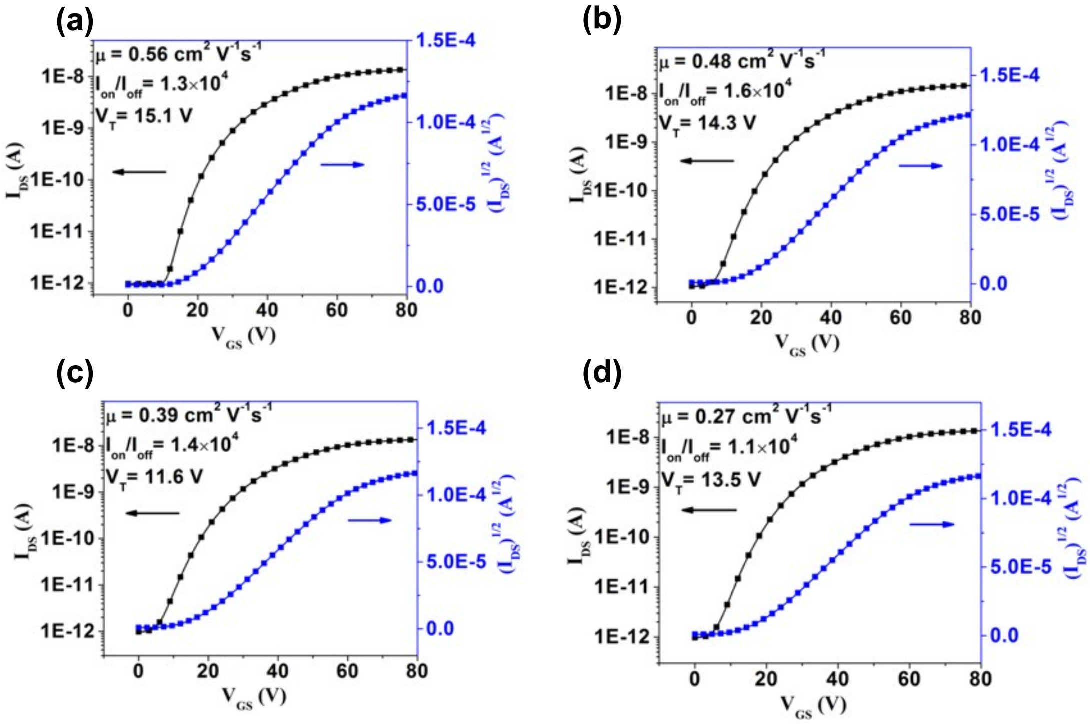

(a)
μ = 2.30 cm2 V-1s-1
Ion/Ioff= 2.4×104
VT= 16.5 V
(b)
μ = 2.03 cm2 V-1s-1
Ion/Ioff= 2.8×104
VT= 15.4 V
(c)
μ = 1.82 cm2 V-1s-1
Ion/Ioff= 1.3×104
VT= 13.9 V
(d)
μ = 1.43 cm2 V-1s-1
Ion/Ioff= 1.3×104
VT= 12.3 V
IDS (A)
(IDS)1/2 (A1/2)
VGS (V)

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.



(a)
μ = 0.56 cm2 V-1s-1
Ion/Ioff= 1.3×10^4
VT= 15.1 V
IDS (A)
(IDS)1/2 (A1/2)
VGS (V)
(b)
μ = 0.48 cm2 V-1s-1
Ion/Ioff= 1.6×10^4
VT= 14.3 V
(c)
μ = 0.39 cm2 V-1s-1
Ion/Ioff= 1.4×10^4
VT= 11.6 V
(d)
μ = 0.27 cm2 V-1s-1
Ion/Ioff= 1.1×10^4
VT= 13.5 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.

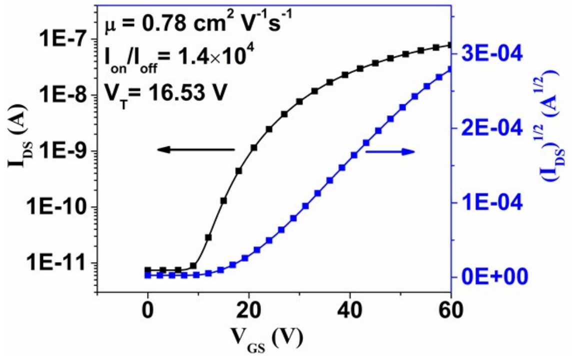


Figure S16 Typical transfer characteristics of OFETs based on C_{60} needle crystals grown from drop cast method with a concentration of 0.5 mg mL^{-1}.

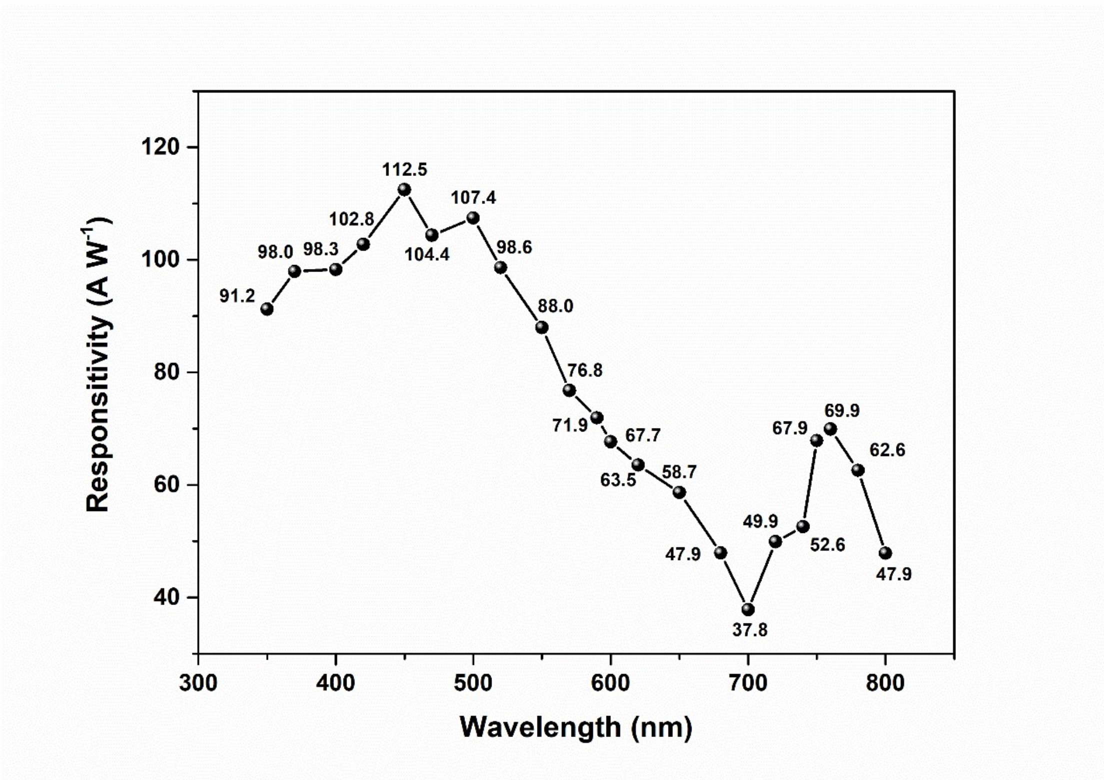


Figure S17 Spectral responsivity of the AVD photodetector measured as a function of illumination wavelength at an applied bias of 30 V.

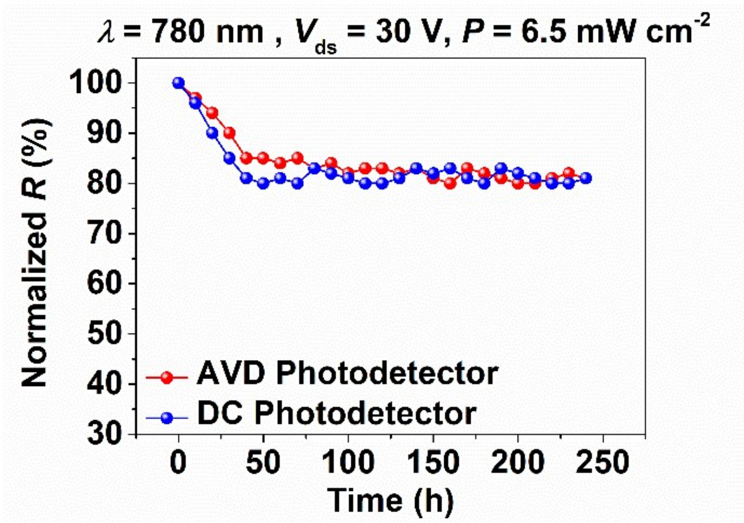


Figure S18 Normalized responsivity of the ACD photodetectors and DC photodetectors in ambient environment without encapsulation as a function of storage time. The temperature and relative humidity is 23 ℃ and 30%.

Table S1 Characteristics of AVD photodetectors based on C_{60} 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}

Antisolvent	C_{C60} (mg mL^{-1})	surface-to-volume ratio	On/off ratio	Responsivity (A W^{-1})
IPA	2.0	~ 6268	26.7	82.6
EtOH	2.0	~ 4157	15.8	50.3
MeOH	2.0	~ 3894	13.3	12.9