Supplementary Information

Influence of the average molar mass of poly(N-vinylpyrrolidone) on dimensions and conductivity of silver nanowires

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Size exclusion chromatography (SEC)

Dimethyl Acetamide Size Exclusion Chromatography

SEC was performed with a Jasco PU-980 HPLC pump and Jasco Jetstream column thermostat using DMAc as the eluent, containing 5 g/L LiBr and 1 vol% Milli-Q®-water with a flow rate of 1 mL/min at 70 °C. The system was equipped with one GRAM 30 (10 µL; 8 x 300 mm; 100-10.000 g/mol) and one GRAM 3000 (10 µL; 8 x 300 mm; 5000 – 500.000 g/mol) analytical column by PSS (Mainz, Germany) for sample separation. The analyte injection volume was 100 µL with a concentration of 4 mg/mL analyte and filtered through a 0.2 µm PTFE syringe filter prior to measurement. For detection, a Jasco RI-930 refractive index (RI) detector was used. The system was calibrated against PVP standards in the range of 2650 g/mol to 147000 g/mol. The sample of 1.300.000 g/mol is not taken into account, because the high molar mass outreached the calibration standards.

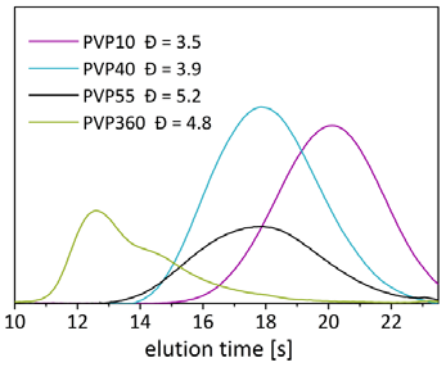

Figure S. 1: Size exclusion chromatography of PVP with M_w = 10,000 g/mol, 40,000 g/mol, 55,000 g/mol and 360,000 g/mol.

Heat treatment of AgNW60 and AgNW80 covered with various PVP

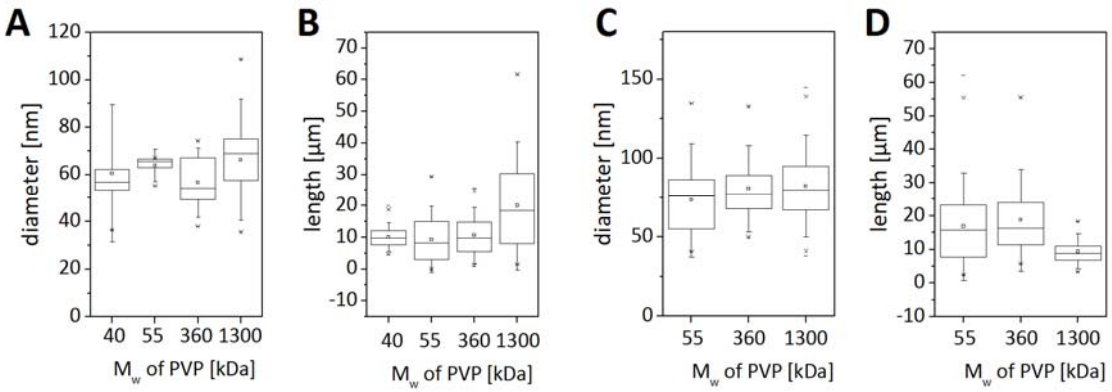

Figure S. 2: Diameters and lengths of AgNW used for conductivity comparison.

Gradual annealing of AgNW60 and AgNW80

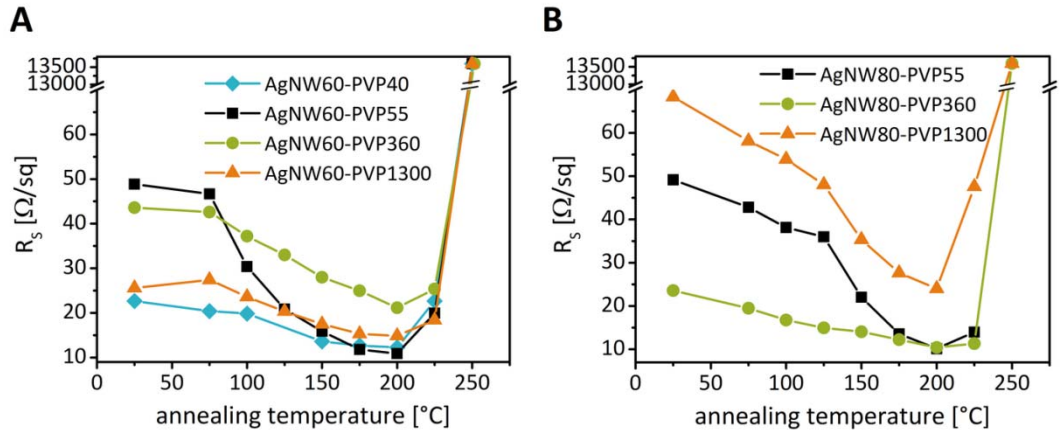

Figure S. 3: Sheet resistance of electrode vs. annealing temperature for A) AgNW60 and B) AgNW80 covered with various PVP.

Solar cell preparation and characterization

For solar cell integration, precleaned and prestructured (2.5×2.5) cm^2 BK7 glass and ITO substrates (Schott, Mainz, Germany) were used. The AgNW dispersion is spray-coated as described beforehand and the electrode was heated for 20 min at 200 °C to obtain low R_S. Then, the electrodes are laterally structured using laser ablation with a Nd:YAG layer (ACI Laser) and treated with argon plasma for 10 min to enhance wettability. PEDOT:PSS "P VP AI 4083", filtered with a 0.45 µm syringe filter, was spin-coated with 800 rpm and heated at 120 °C for 15 min in air.

C60 (CreaPhys, Dresden, Germany), 2,2-((3,4-dimethyl-[2,2:5,2:5,2:5,2-quinquethiophene]-5,5-diyl)bis(methanylylidene))-dimalononitrile (DCV5T-Me), N,N'-bis(9,9-dimethyl-9Hfluoren-2-yl)-N,N'-diphenylbiphenyl-4,4'-diamine (BF-DPB; Synthon, Wolfen, Germany), N,N-bis(fluoren-2-yl)naphthalenetetracarboxylic diimide (bis-HFl-NTCDI; synthesized in-house), tetrakis(1,3,4,6,7,8-hexahy- dro-2H-pyrimidol[1,2-a]pyrimidinato)ditungsten (W2(hpp)4), "Novaled P Dopant 9" (NDP9), 2,2'-(perfluoronaphthalene-2,6- diylidene)dimalononitrile (F6-TCNNQ; Novaled AG, Dresden, Germany), 9,9-bis[4-(N,N-bis(biphenyl-4-yl)amino)phenyl]-9H-fluorene (BPAPF; Lumtec, Hsin-Chu, Taiwan), molybdenum oxide (Sigma-Aldrich, Munich, Germany), gold (Allgemeine Gold- and Silberscheideanstalt AG, Pforzheim, Germany), silver and aluminium (Lesker, Hastings, U.K.) are deposited using a single-chamber thermal evaporation system at a base pressure of 1×10^{-8} mbar (Lesker). All organic materials are purified at least twice by gradient sublimation. The layer sequence is schematically depicted in Figure S. 1 A. For top encapsulation purposes, getter-containing cavity glasses are glued on top of the devices using epoxy XNR 5592 (Nagase, Tokyo, Japan) under nitrogen atmosphere.

External quantum efficiency (EQE) measurements for spectral mismatch correction are carried out using a lock-in amplifier under monochromatic illumination. Initial IV curves are recorded spectrally mismatch corrected using a source measurement unit (Keithly, Cleveland, OH, USA) under AM1.5G irradiation at 1000 W m^{-2} with a sun simulator "16 S-003-300" (SolarLight Co. Inc., Glenside, PA, USA).

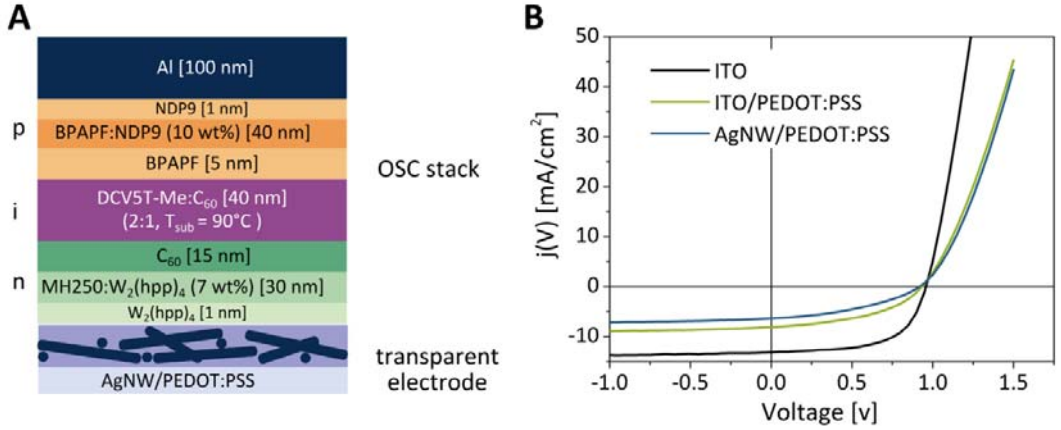

Figure S. 4: A) Scheme of DCV5T-Me and C_{60} organic solar cell and B) current density versus voltage characteristics of organic solar cells with ITO or AgNW/PEDOT:PSS as bottom electrode.

The schematic layer stack of the OSC is shown in Figure S. 4 A. Custom encapsulation glasses with a getter-filled cavity serve as the top encapsulation. Figure S. 4 B presents the current density versus voltage (*jV*) characteristics of the organic devices, and summarizes the electrode and photovoltaic performance parameters. ITO-based devices exhibit a PCE of 7,1 % with open-circuit voltage (VOC), short-circuit current density (j_{SC}), and fill factor (FF) of 0.96 mV, 13.04 mA/cm^2, and 60.5%. With a AgNW/PEDOT:PSS electrode, a PCE of 2.3% is reached exhibiting VOC, j_{SC}, and FF values of 0.92 mV, 6.24 mA/cm^2, and 38.38%, respectively.

Table S 1: Electrode and photovoltaic performance parameters of DCV5T-Me:C60 solar cells on ITO or AgNW/PEDOT:PSS as transparent bottom electrodes. For each solar cell type, 1 to 2 samples containing 4 devices are prepared under identical conditions. Values in brackets are the highest measured within this category.

Type	**R_S [Ω/sq]**	**$\%T_{550nm}$**	**j_{SC} [mA/cm^2]**	**V_{OC} [mV]**	**FF [%]**	**PCE [%]**
ITO	28	81.5	12.25 (12.85)	0.96 (0.96)	60.5 (60.97)	7.1 (7.3)
AgNW/PEDOT:PSS	24.4	85.5	6.24 (6.36)	0.92 (0.92)	38.38 (39.93)	2.3 (2.43)
ITO/PEDOT:PSS	30.4	85.1	7.79 (8.1)	0.93 (0.93)	42.66 (45.38)	3.1 (3.42)