Supporting Information for "Degradation of Flexible, ITO-Free Oligothiophene Organic Solar Cells"

Ludwig Bormann,[*,†] Frederik Nehm,[†] Luisa Sonntag,[‡,¶] Fan-Yu Chen,[†] Franz Selzer,[†] Lars Müller-Meskamp,[†] Alexander Eychmüller,[‡,¶] and Karl Leo[*,†,§]

†*Institut für Angewandte Photophysik, Technische Universität Dresden, George-Bähr-Str. 1, 01069 Dresden, Germany*

‡*Physikalische Chemie, Technische Universität Dresden, Bergstraße 66b, 01062 Dresden, Germany*

¶*Cluster of Excellence Center for Advancing Electronics Dresden (CFAED)*

§*Fellow of the Canadian Institute for Advanced Research (CIFAR)*

E-mail: ludwig.bormann@iapp.de; leo@iapp.de

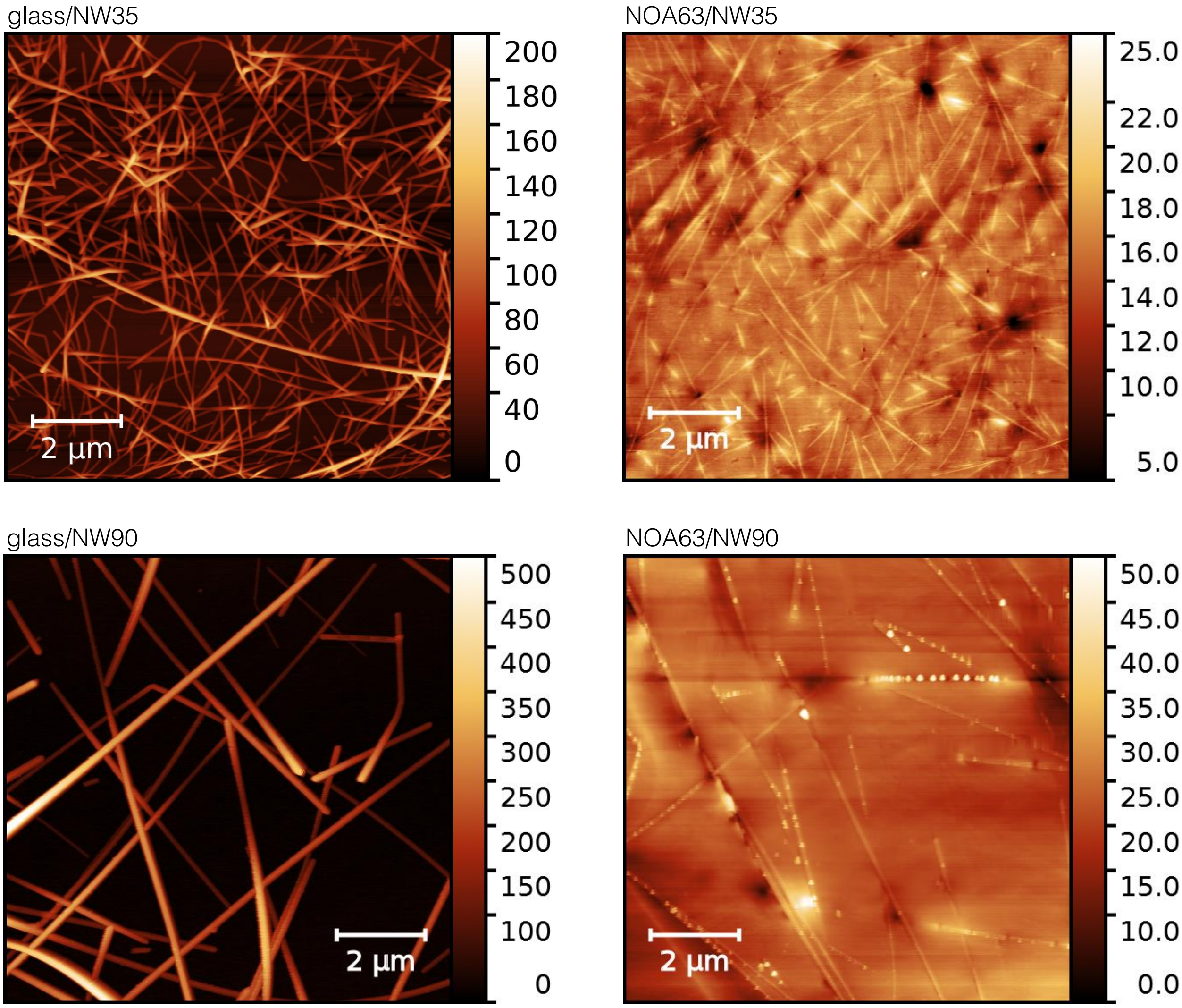

Figure S1: Atomic force microscopy images of silver nanowire electrodes NW90 and NW35 on glass and embedded in NOA63. Image size is $(10 \times 10)\,\mu m^2$, scale values are given in nm.

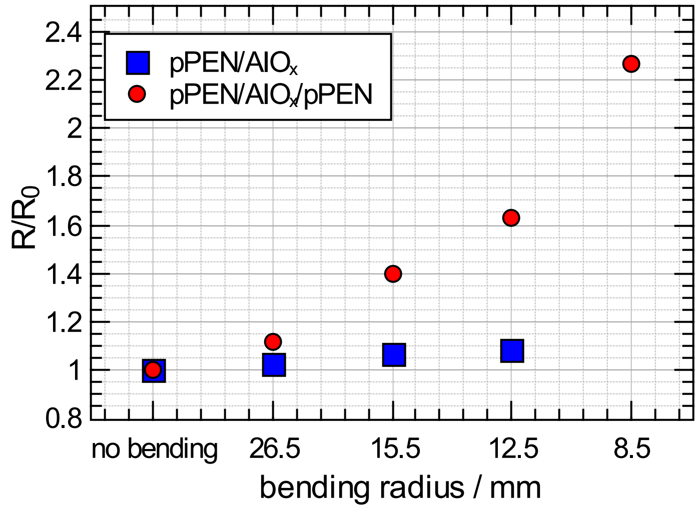

Figure S2: Resistance measurements of transparent metal electrode on pPEN/AlO_x barrier substrate. The barrier cracks at a bending radius of 8.5 mm which destroys the TME conductivity. In one case, an additonal pPEN substrate was laminated on top of the TME to move the AlO_x layer into the neutral plane. Here, the TME breaks down at 5 mm bending radius. The increase in resistance over time is due to issues concerning the electrical contacting.

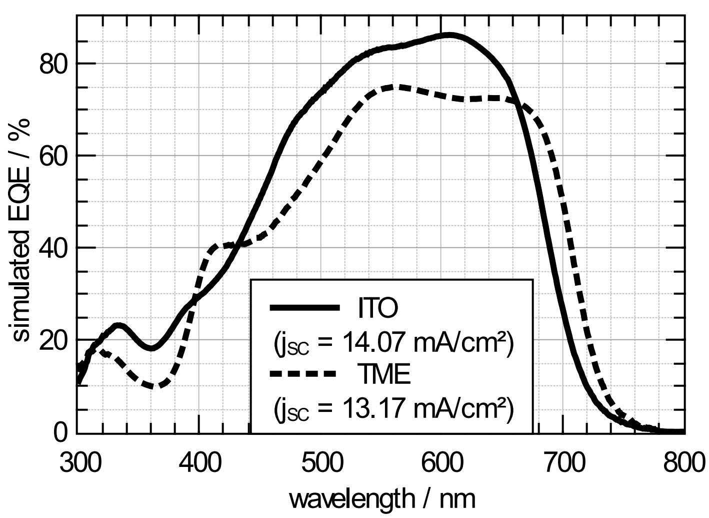

Figure S3: Simulated EQE data for DCV5T-Me:C_{60} organic solar cells on thin ITO or TME with calculated j_{SC} values. An optical simulation is employed using n and k values of all layers of the organic solar cell excluding the substrate. Following layer stack is used for calculation (bracket values in nm): ITO [90] or TME (BF-DPB:F_6-TCNNQ 10 wt% [20] MoO_3 [3] Au [1] Ag [9]) Bis-HFl-NTCDI [5] C_{60} [15] DCV5T-Me:C_{60} 2:1 [40] BPAPF [5] BPAPF:NDP9 10 wt% [30] BF-DPB:F_6-TCNNQ 10 wt% [10] Al [100]. Note, that absolute j_{SC} values are not in full agreement with experiment as substrate absorption and layer morphology is not considered in the simulation.

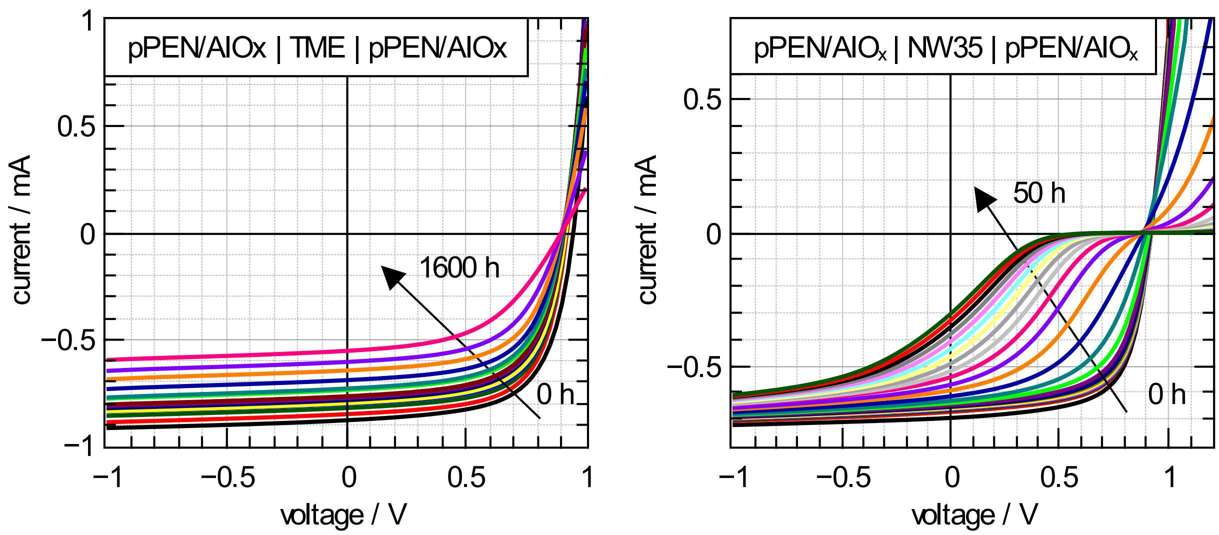

Figure S4: IV curves of solar cells at different stages of aging in 38 °C, 90 % RH climate. **Left:** Degradation of samples with transparent metal electrode (TME) and flexible pPEN/AlO_x as ultra-barrier. One curve every 100 h is plotted. **Right:** Silver nanowires (35 nm diameter) embedded in NOA63 is used as transparent electrode and encapsulated with pPEN/AlO_x. One curve per hour is plotted.