Supporting Information

Performance and Stability of Aerosol Jet Printed Electrolyte-Gated Transistors based on Poly(3-hexylthiophene)

Se Hyun Kim[1,2], *Kihyon Hong*[1], *Keun Hyung Lee*[1], and *C. Daniel Frisbie*[1,*]

[1]Department of Chemical Engineering & Materials Science, University of Minnesota, 421 Washington Ave. SE, Minneapolis, MN 55455 (USA)

[2]Department of Advanced Organic Materials Engineering, Yeungnam University, 280 Daehak-ro, Gyeongsan, 712-749 (Korea)

*Corresponding Author Email Address: frisbie@umn.edu

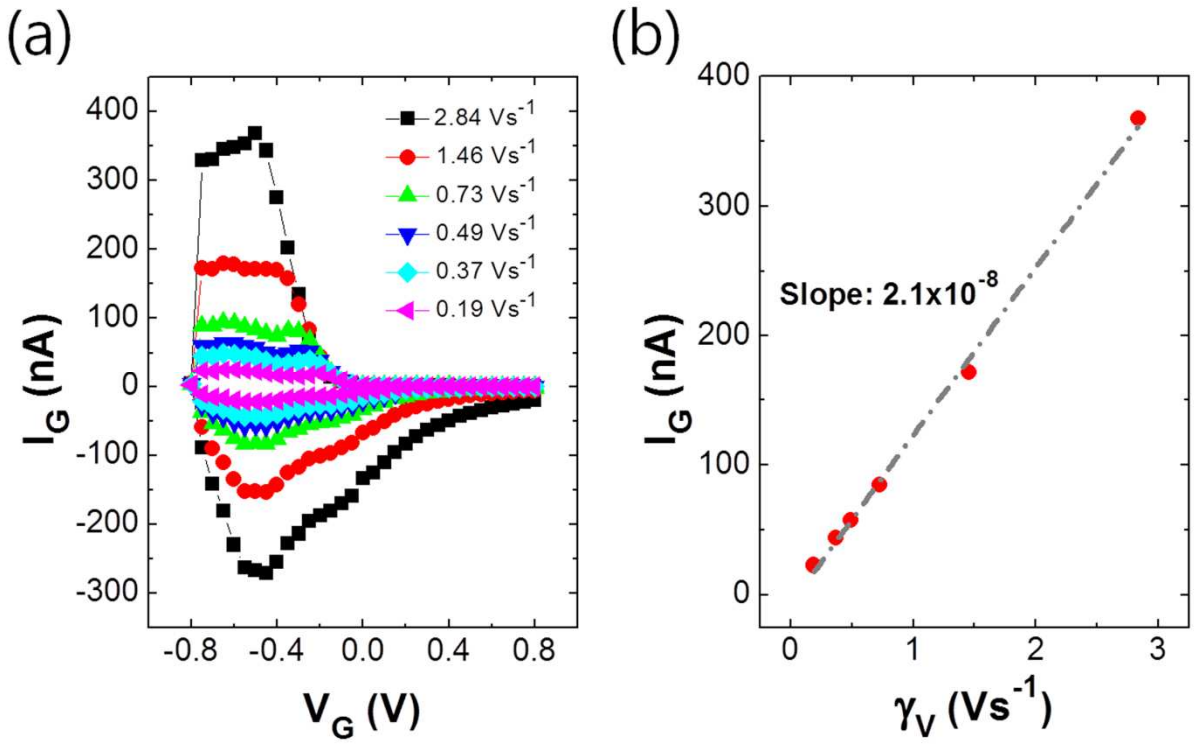

Figure S1. (a) Gate current (I_G)–V_G characteristics obtained at different gate sweeping rates (γ_V) for 50 nm-thick P3HT EGT (V_D = 0 V). (b) A plot of I_G versus γ_V at V_G= -0.5 V.The C_i value of ion gel gate insulator was obtained from the slope of the plot divided by the channel area.

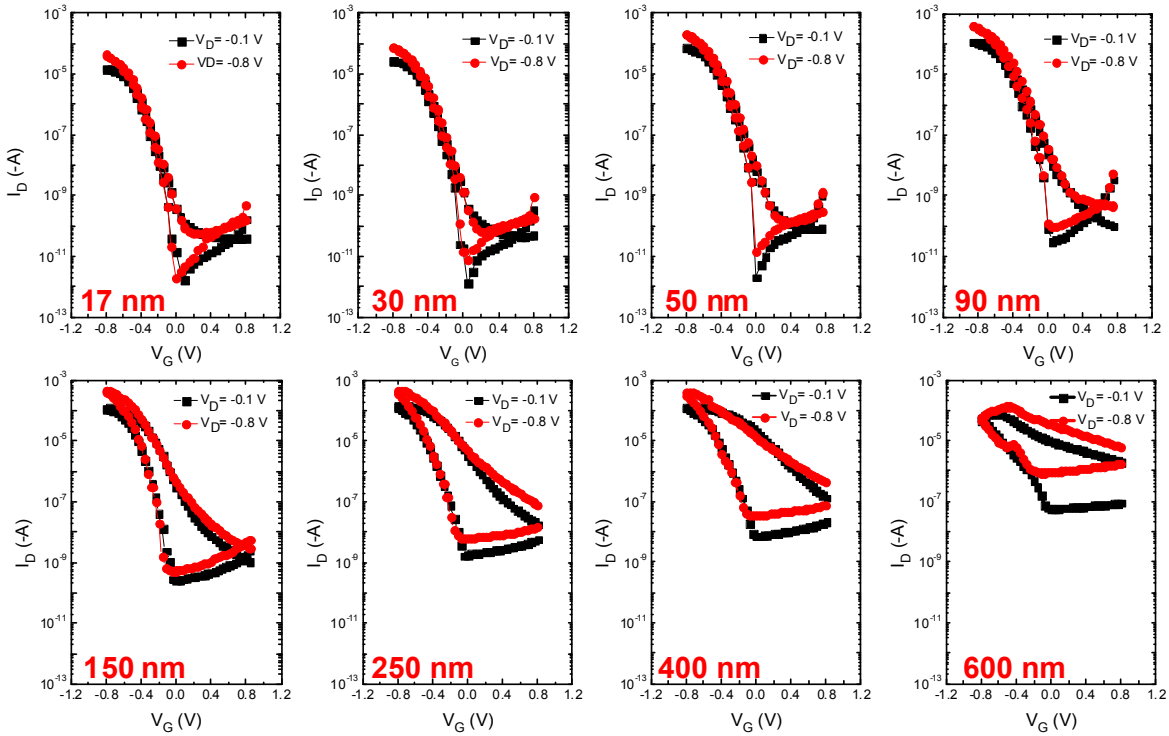

Figure S2. Effect of P3HT thickness. I_D–V_G transfer curves for the printed EGTs on SiO_2 substrate with different P3HT thickness (from 15 to 600 nm). Red labels represent the P3HT thickness applied in the EGTs. The gate sweep rate was 100 mV s^{-1}, and annealing for EGTs was carried out at 120 °C for 30 min.

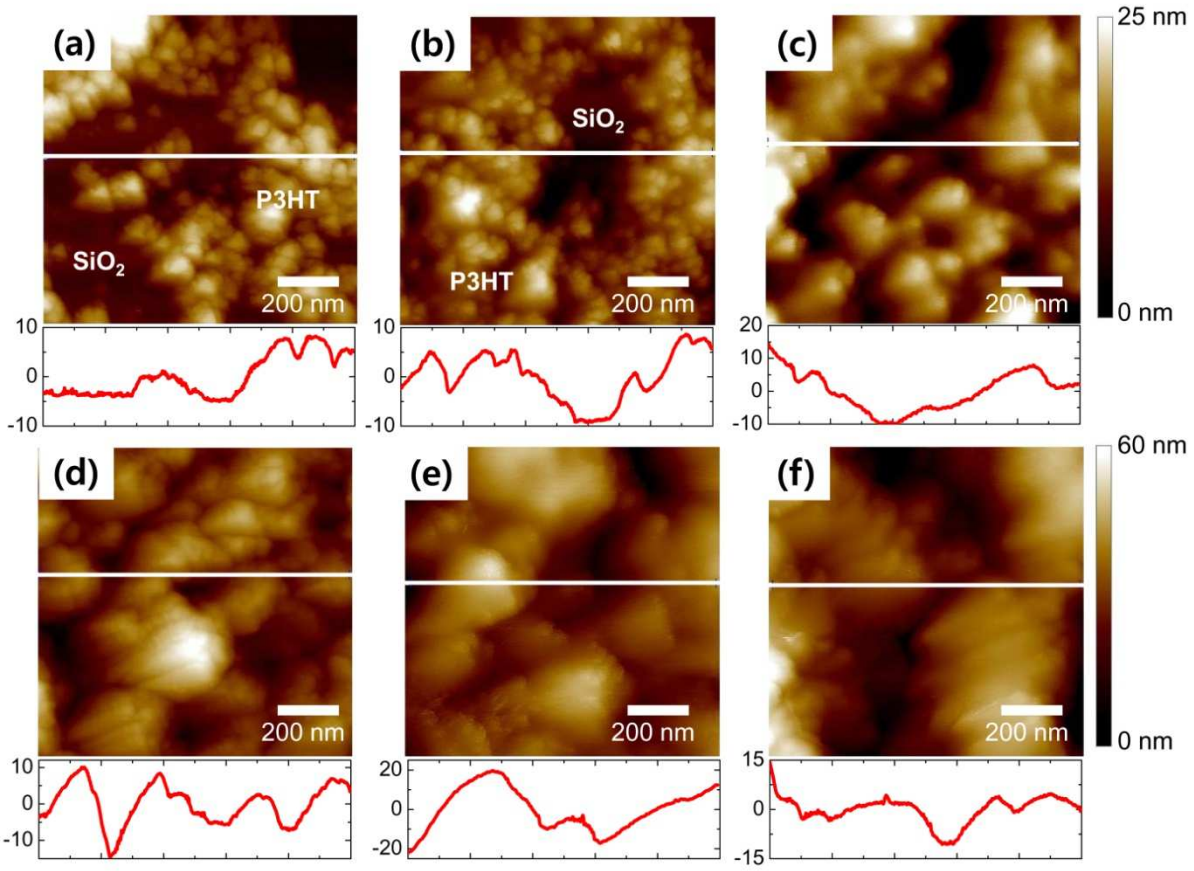

Figure S3. Surface morphologies and cross-sections for the printed P3HT films on SiO_2 substrate characterized by AFM: (a) 10 nm-, (b) 20 nm-, (c) 50 nm-, (d), 100 nm-, (e) 200 nm-, and (f) 300 nm-thick films. The P3HT films were annealed at 60 ℃ for 30 min in ambient air. The y-axis unit for cross-sections of the P3HT is nm.

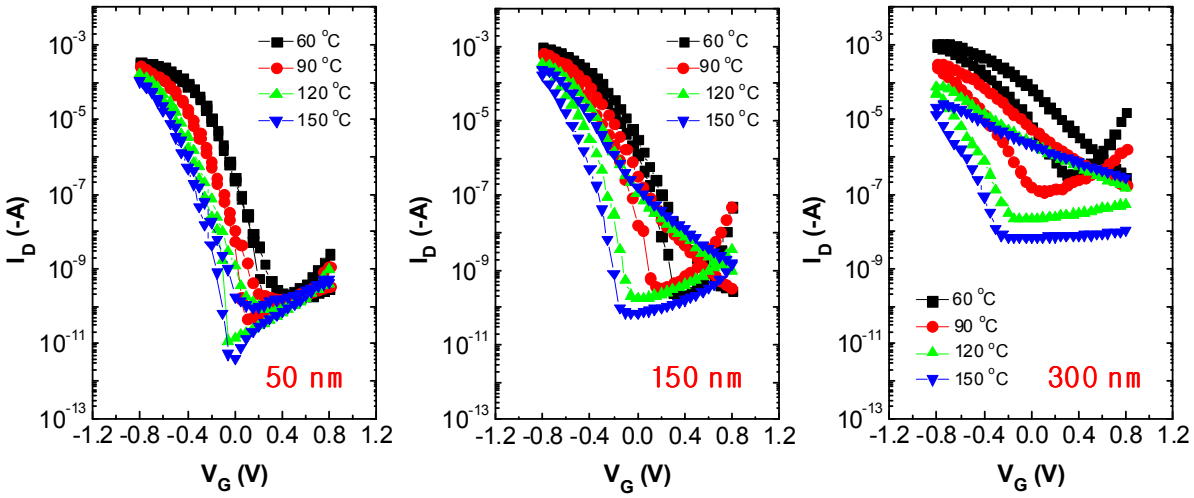

Figure S4. Log I_D–V_G transfer curves at different device annealing temperatures for printed EGTs with different P3HT thicknesses: (a) 50 nm, (b) 150 nm, and (c) 300 nm. The gate sweep rate was 100 mV s^{-1}.

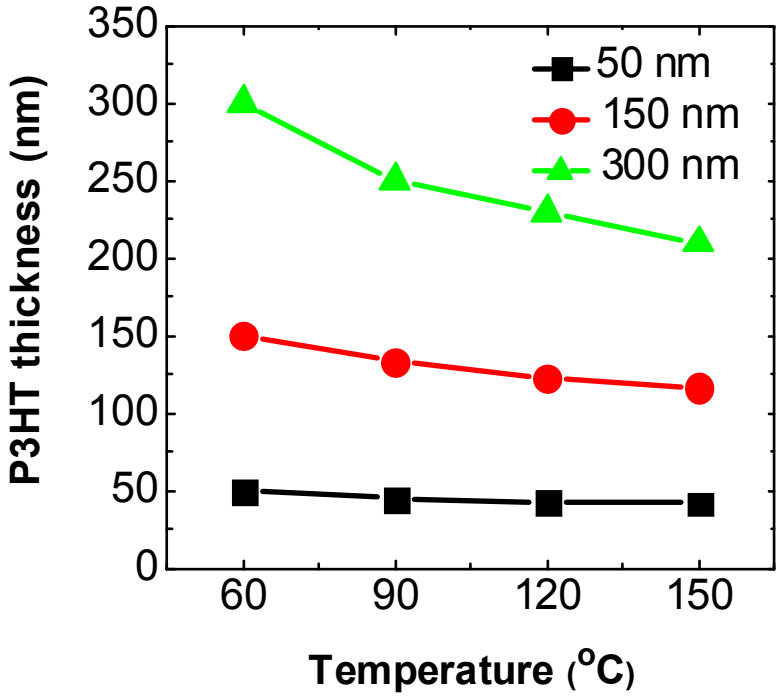

Figure S5. The thickness change of P3HT films depending on thermal annealing. The initial P3HT thickensses are 50 nm (black), 150 nm (red), 300 nm (green).

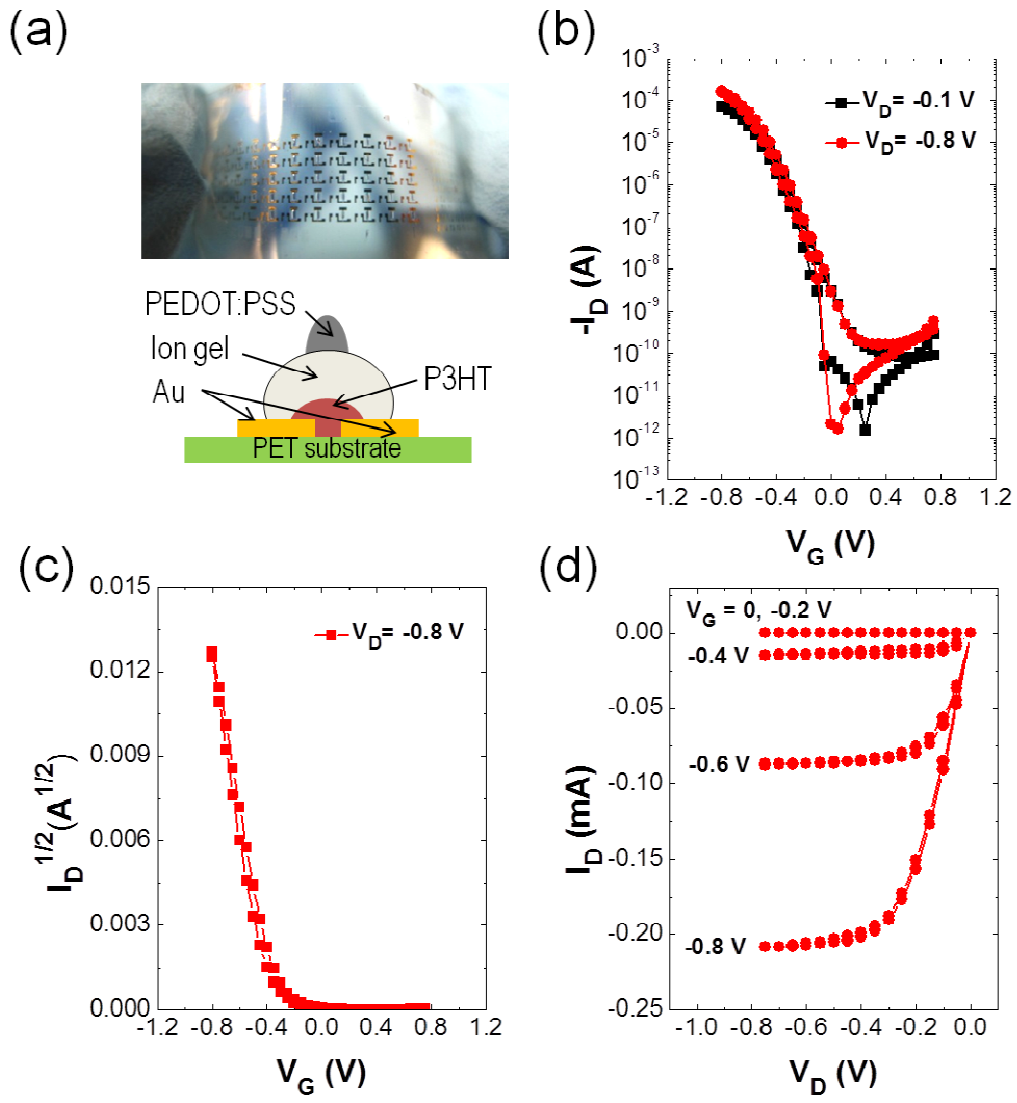

Figure S6. (a) Photograph (upper) of an array of printed P3HT EGTs on flexible PET substrate. The devices were annealed at 120 °C for 30 min. Lower panel shows a cross-sectional scheme of a printed EGT. P3HT thickness was 50 nm. (b) Log I_D–V_G transfer characteristics in both linear (V_D= -0.1 V) and saturation regimes (V_D= -0.8 V). (c) $I_D^{1/2}$–V_G transfer characteristics, and (d) I_D–V_D output characteristics. The sweep rates of V_G (transfer) and V_D (output) were both 100 mV s^{-1}.