10.1071/CH15283_AC

Australian Journal of Chemistry 2015, 68(11), 1741-1749

SUPPLEMENTARY MATERIAL

Study of Vertical and Lateral Charge Transport Properties of DPP-Based Polymer/$PC_{61}BM$ Films Using Space Charge Limited Current (SCLC) and Field Effect Transistor Methods and their Effects on Photovoltaic Characteristics

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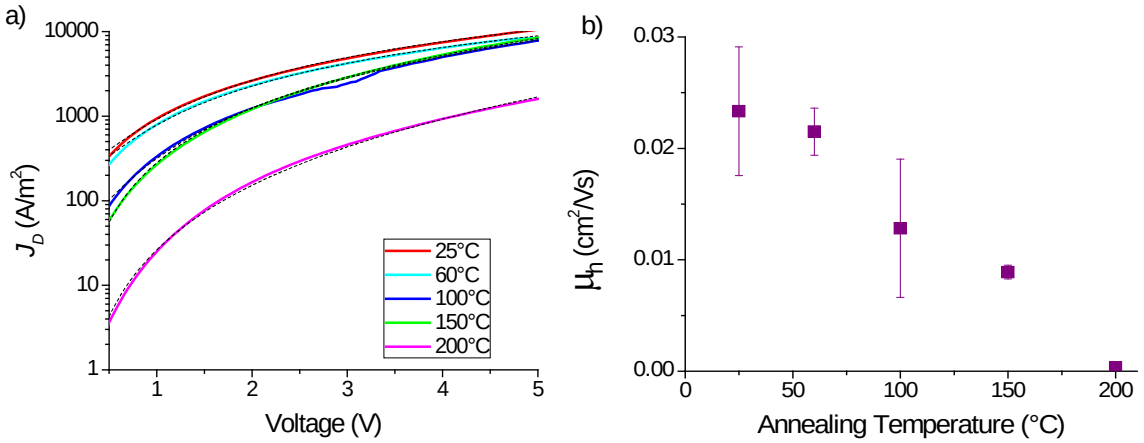
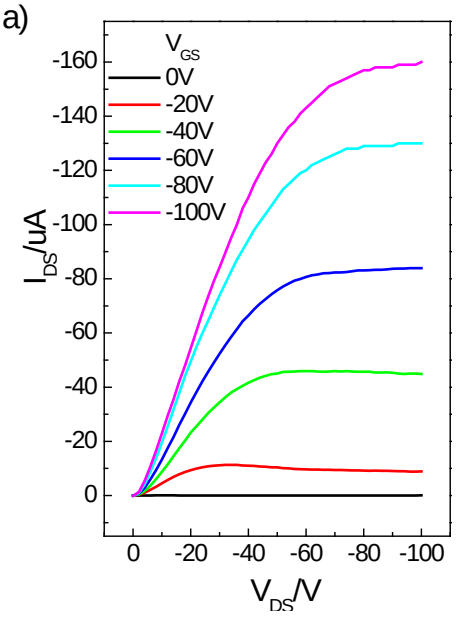


Figure S1. a) *J-V* characteristics measured in the dark and fit with the Mott-Gurney equation (black, dotted lines) and b) SCLC μ_h of hole-only devices annealed at various temperatures, prepared using pure PDBFBT films. Film thicknesses of devices annealed at 25 °C, 60 °C, 100 °C, 150 °C, and 200 °C were 351 nm, 334 nm, 389 nm, 372 nm, and 437 nm, respectively.

a)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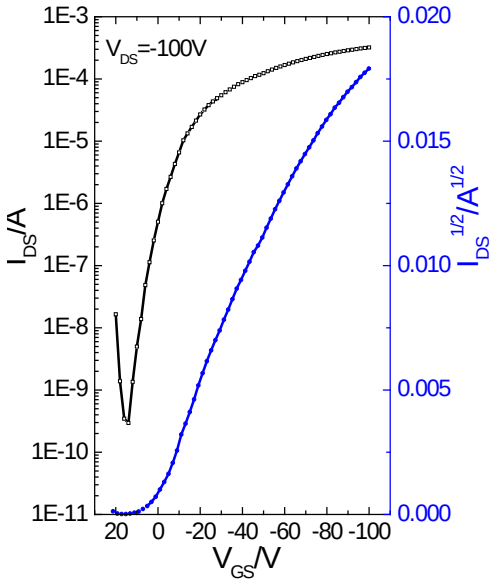
I_DS/uA
V_DS/V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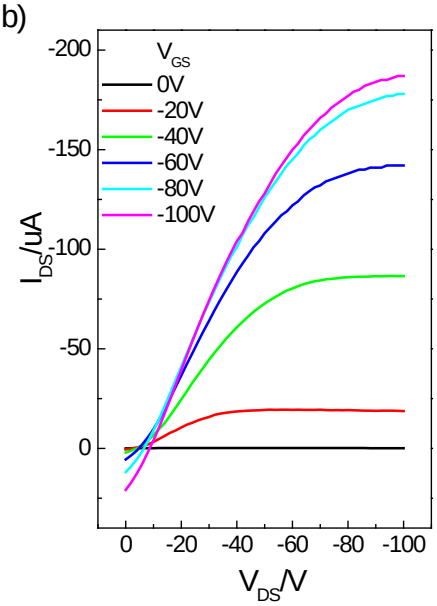
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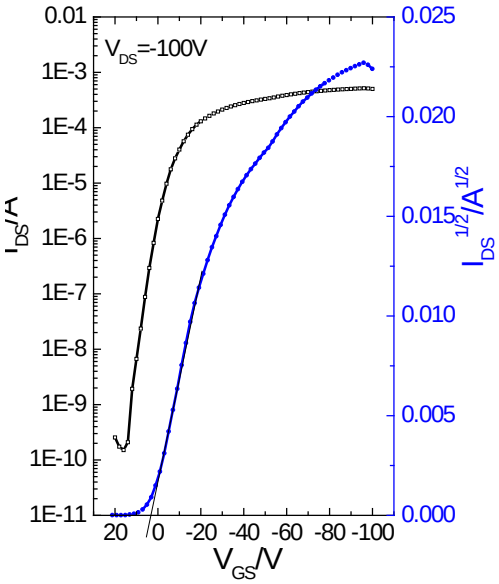
V_DS/V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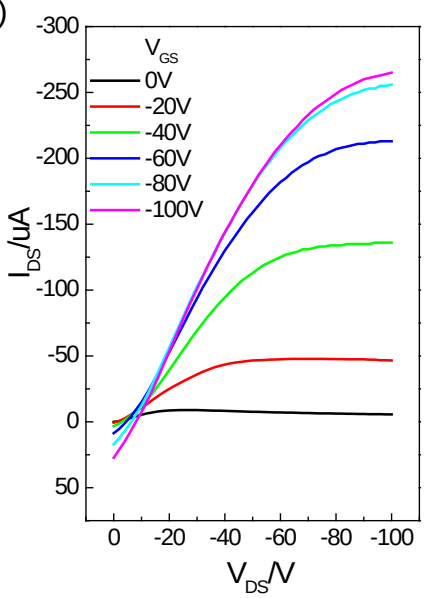
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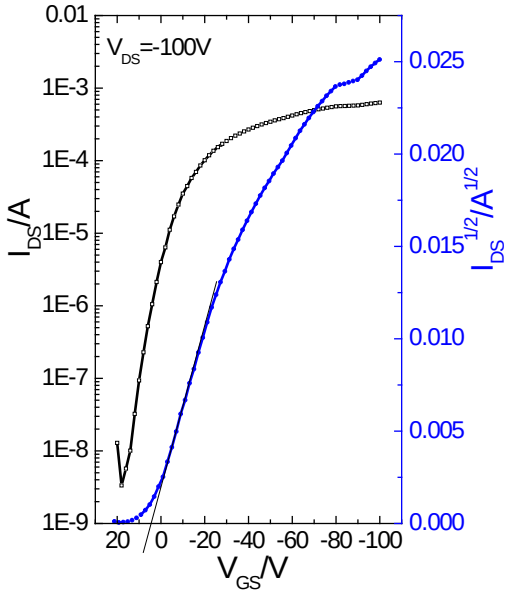
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d)

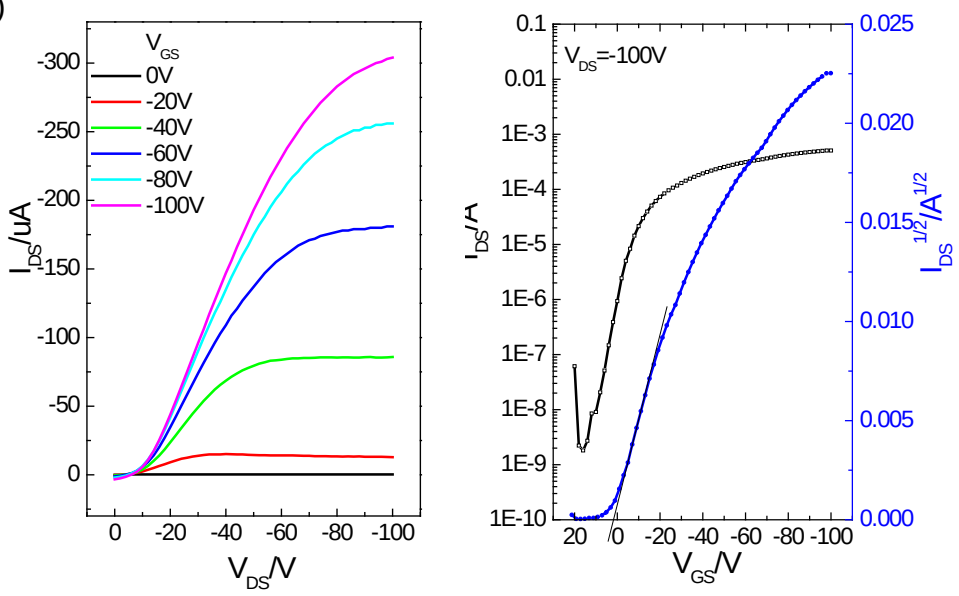
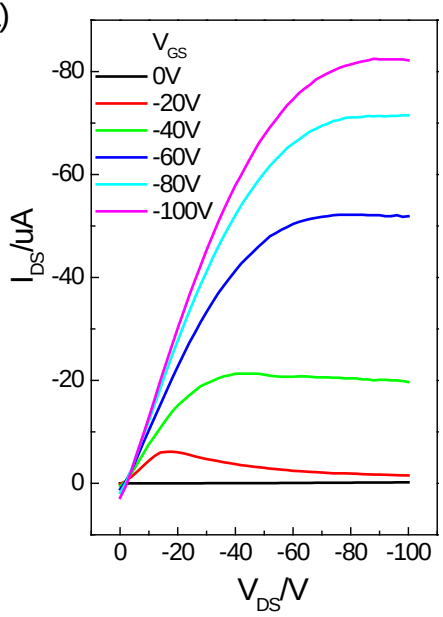


Figure S2. Output (left) and transfer (right) characteristics of hole accumulation regimes of pure PDBFBT films annealed at a) 50 °C, b) 100 °C, c) 150 °C, and d) 200 °C. L = 30 µm, W = 1 mm.

a)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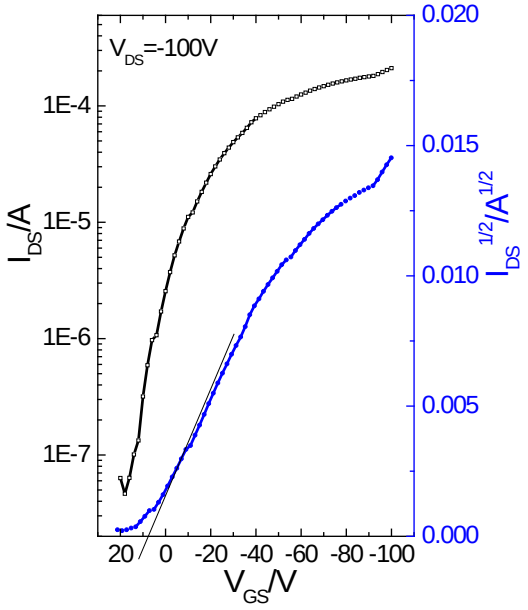
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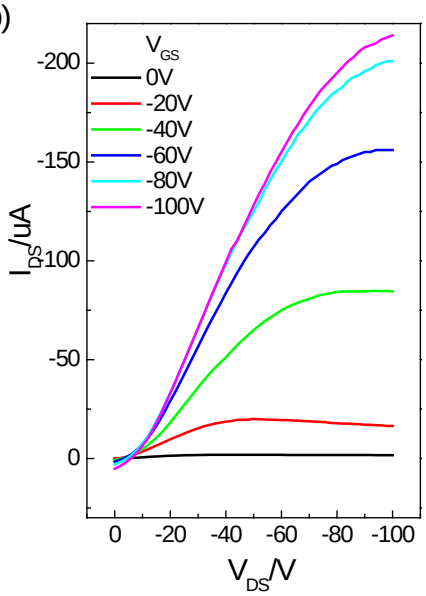
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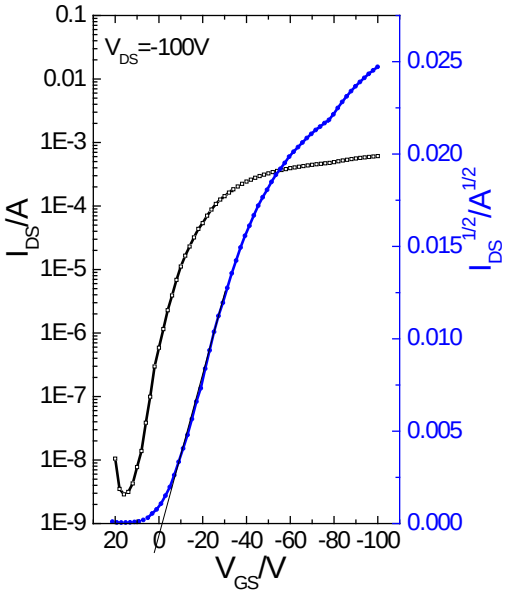
V_DS/V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V_GS/V

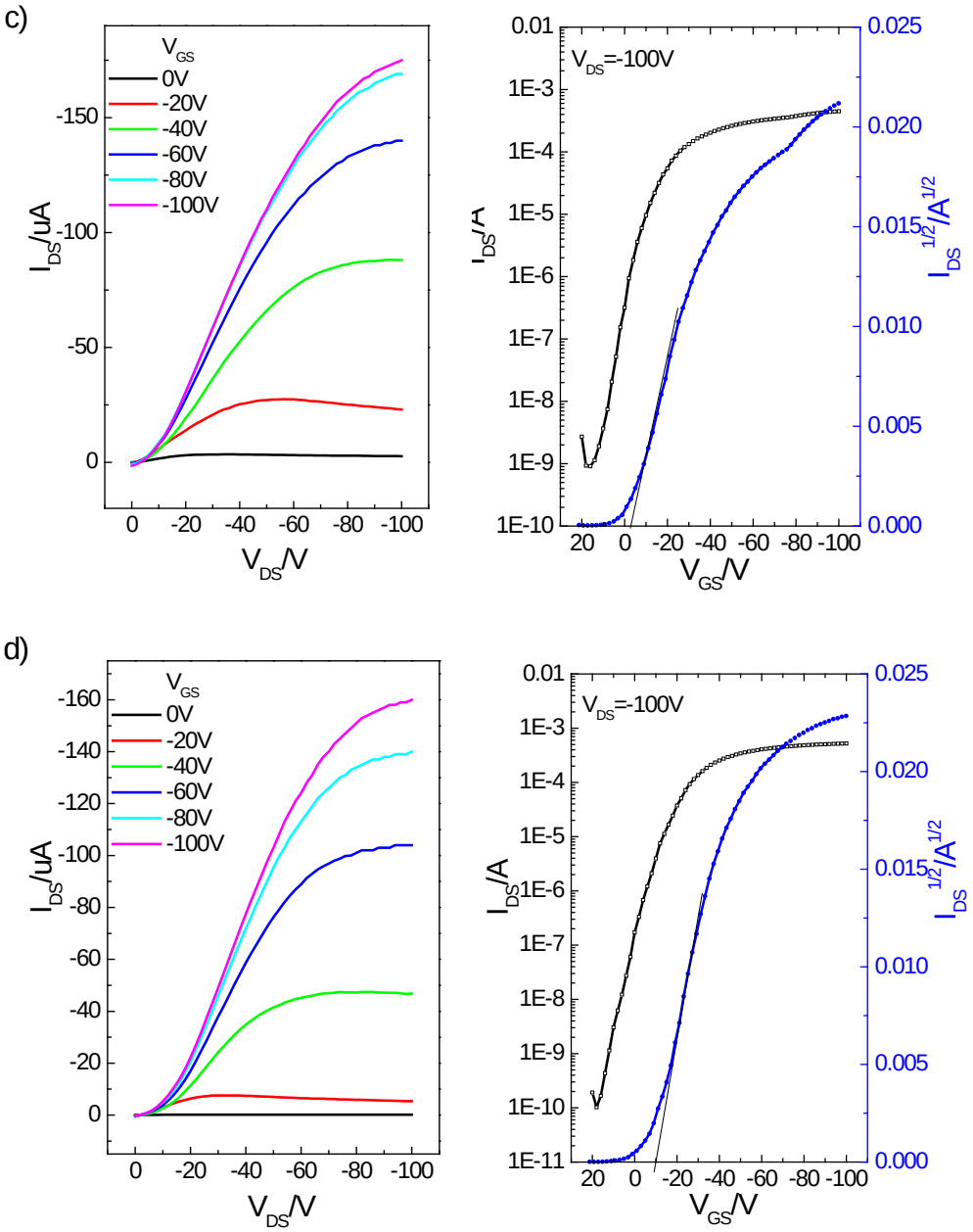
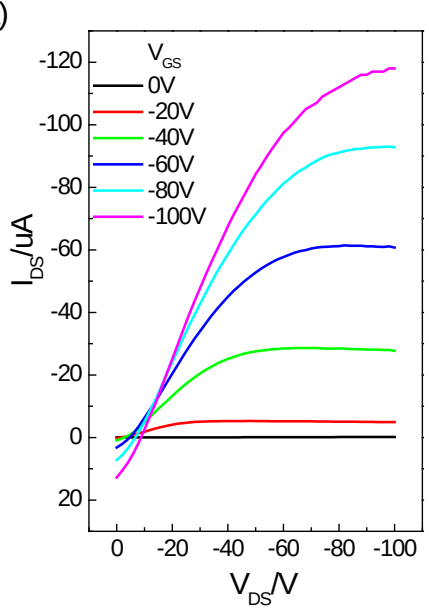


Figure S3. Output (left) and transfer (right) characteristics of hole accumulation regimes of PDBFBT:$PC_{61}BM$ films (D/A = 1/1) annealed at a) 50 °C, b) 100 °C, c) 150 °C, and d) 200 °C. L = 30 μm, W = 1 mm.

a)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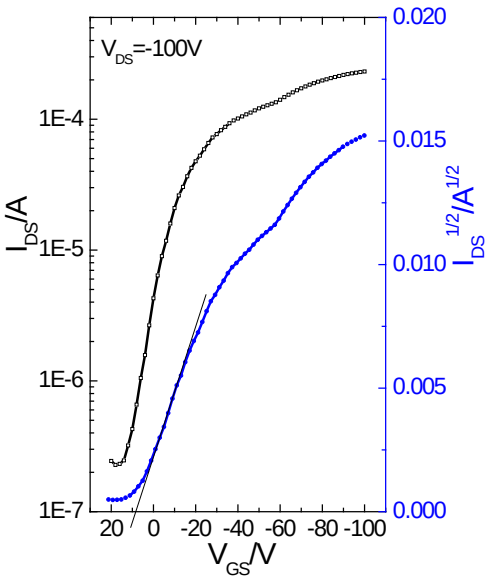
I_DS/uA
V_DS/V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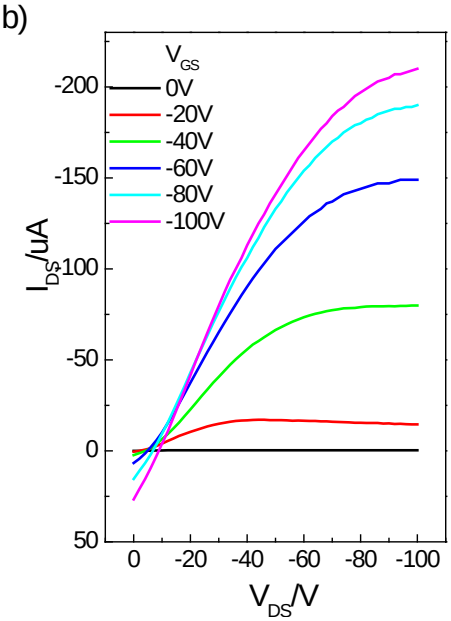
V_GS/V

b)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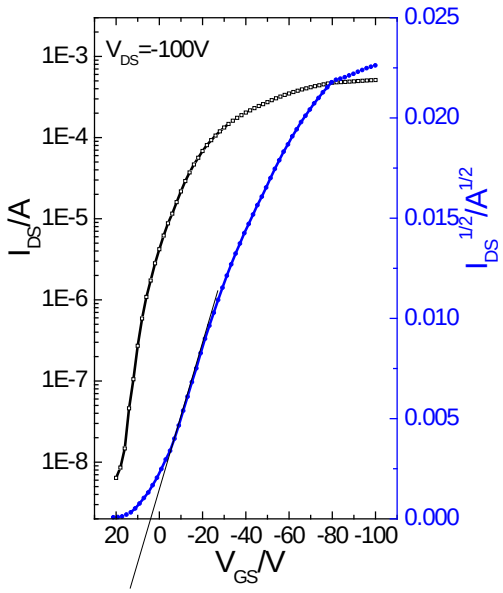
I_DS/uA
V_DS/V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V_GS/V

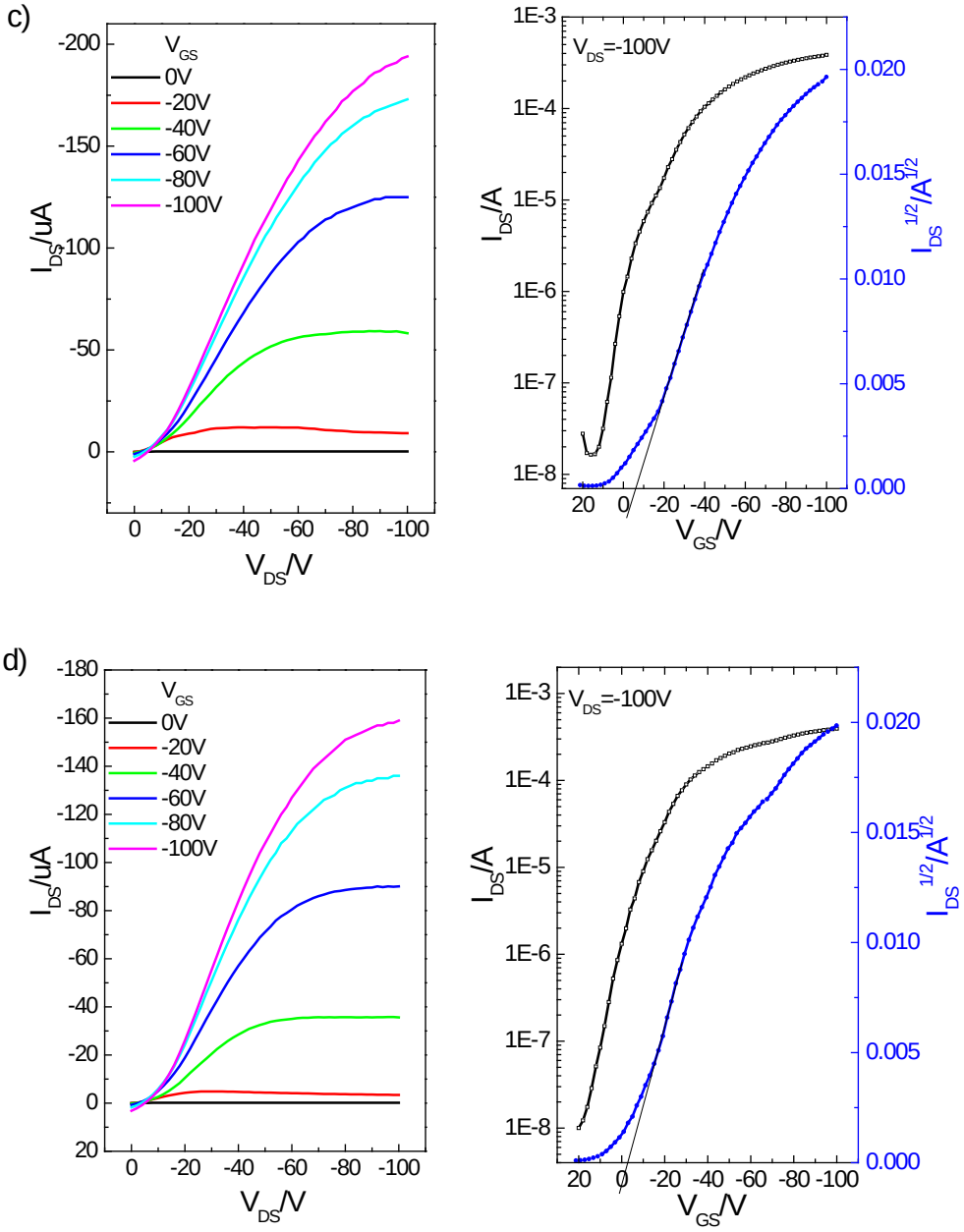
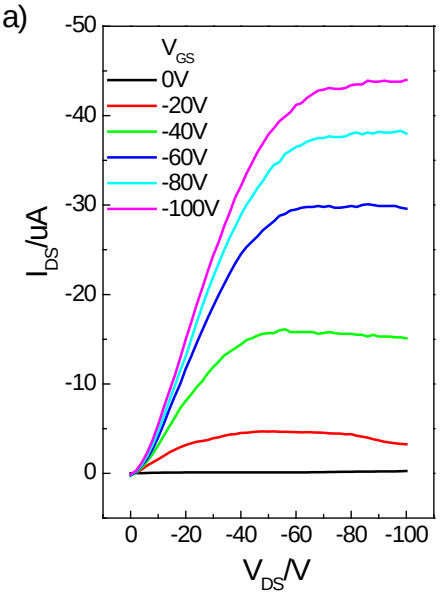


Figure S4. Output (left) and transfer (right) characteristics of hole accumulation regimes of PDBFBT:$PC_{61}BM$ films (D/A = 1/2) annealed at a) 50 °C, b) 100 °C, c) 150 °C, and d) 200 °C. L = 30 µm, W = 1 mm.

a)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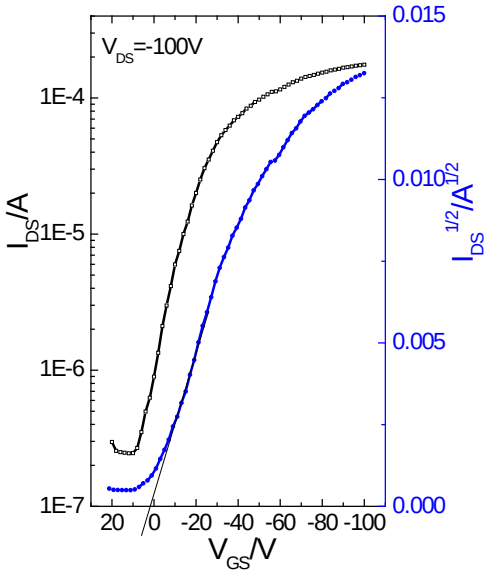
I_DS/uA
V_DS/V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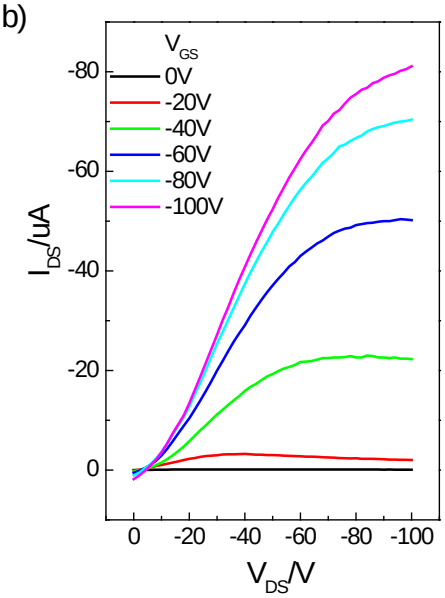
I_DS^1/2/A
V_GS/V

b)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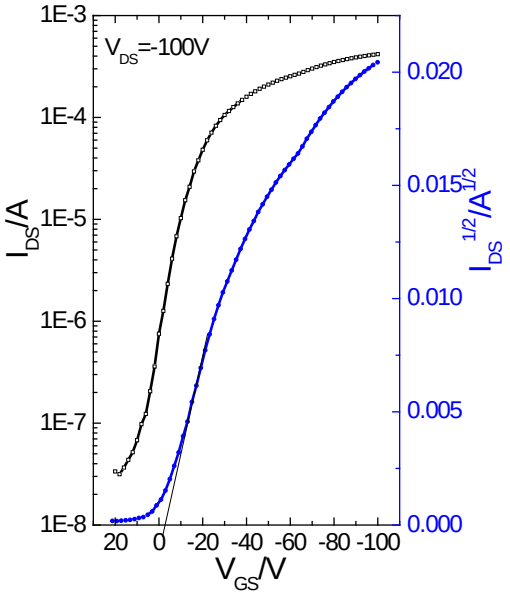
I_DS/uA
V_DS/V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V_GS/V

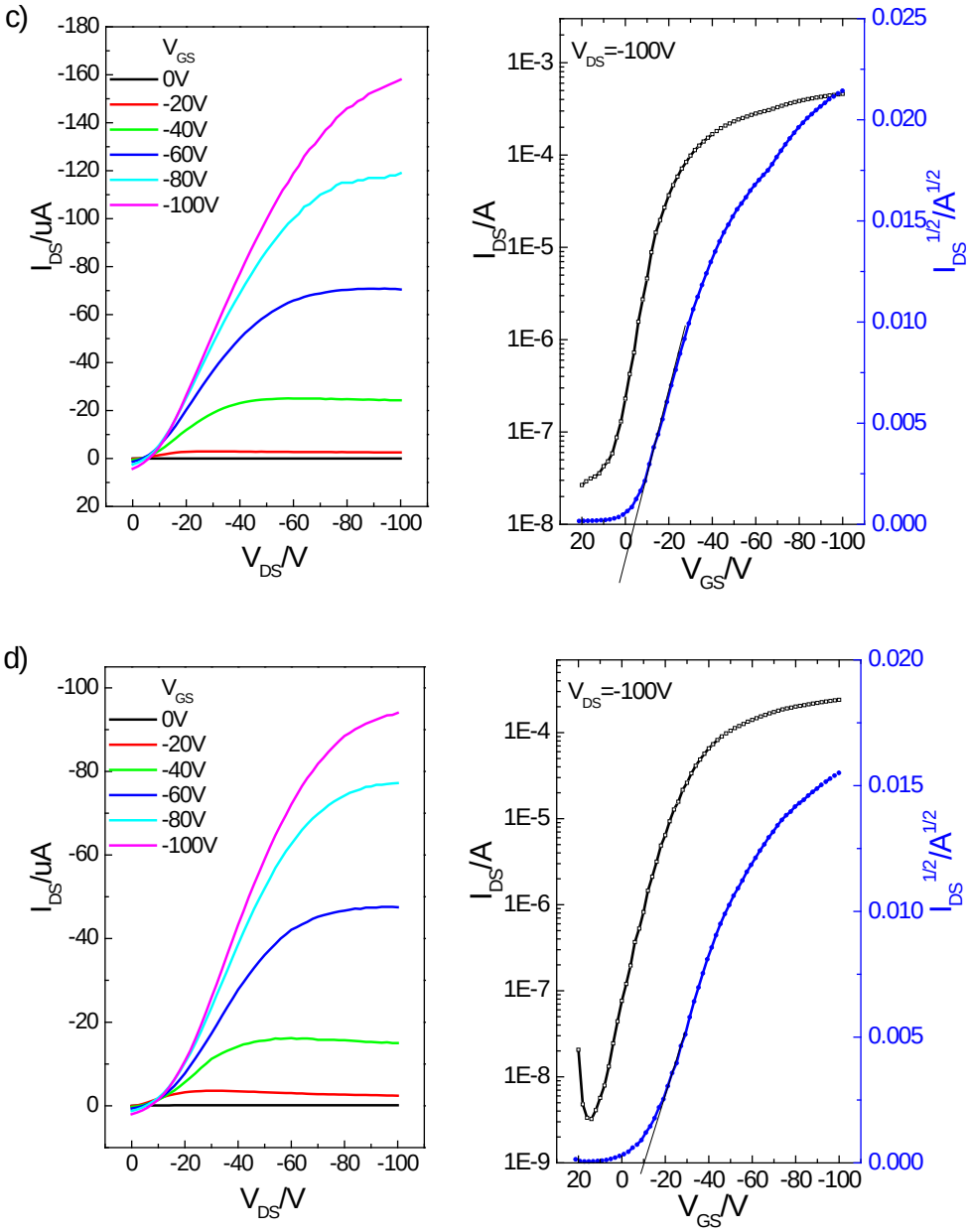
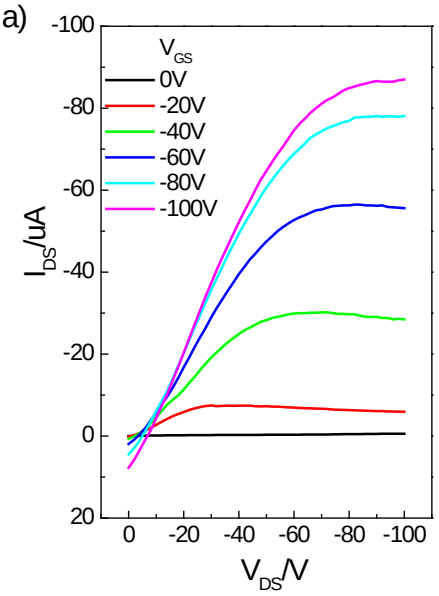


Figure S5. Output (left) and transfer (right) characteristics of hole accumulation regimes of PDBFBT:$PC_{61}BM$ films (D/A = 1/3) annealed at a) 50 °C, b) 100 °C, c) 150 °C, and d) 200 °C. L = 30 µm, W = 1 mm.

a)


V_GS
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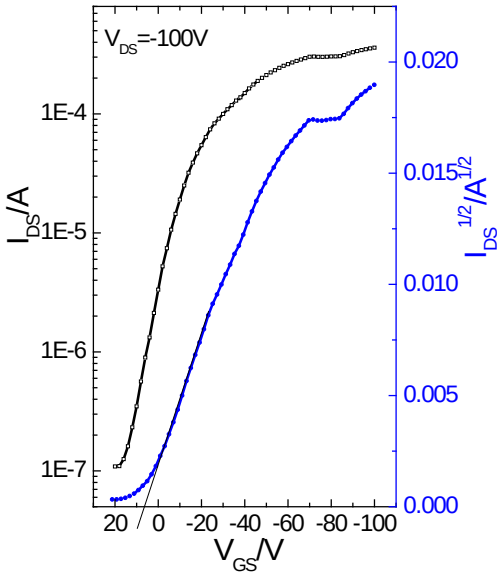
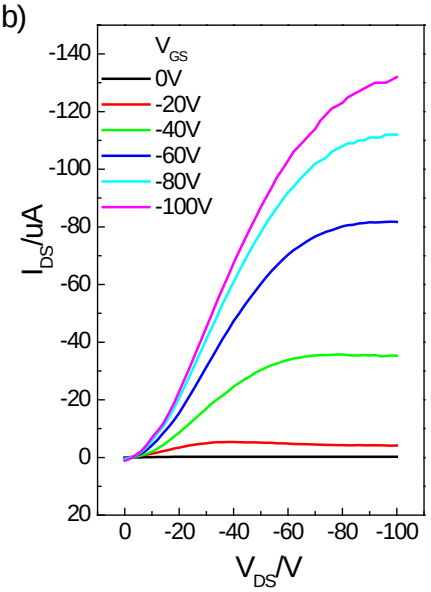
-20V
-40V
-60V
-80V
-100V
I_DS/uA
V_DS/V


V_DS=-100V
I_DS/A
I_DS^1/2/A^1/2
V_GS/V

b)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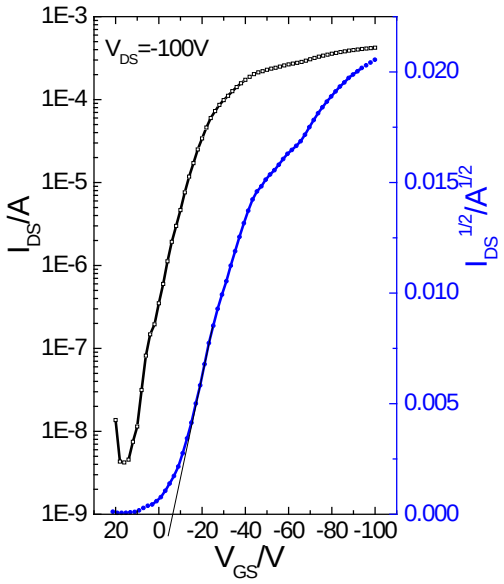
-40V
-60V
-80V
-100V
I_DS/uA
V_DS/V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V_GS/V

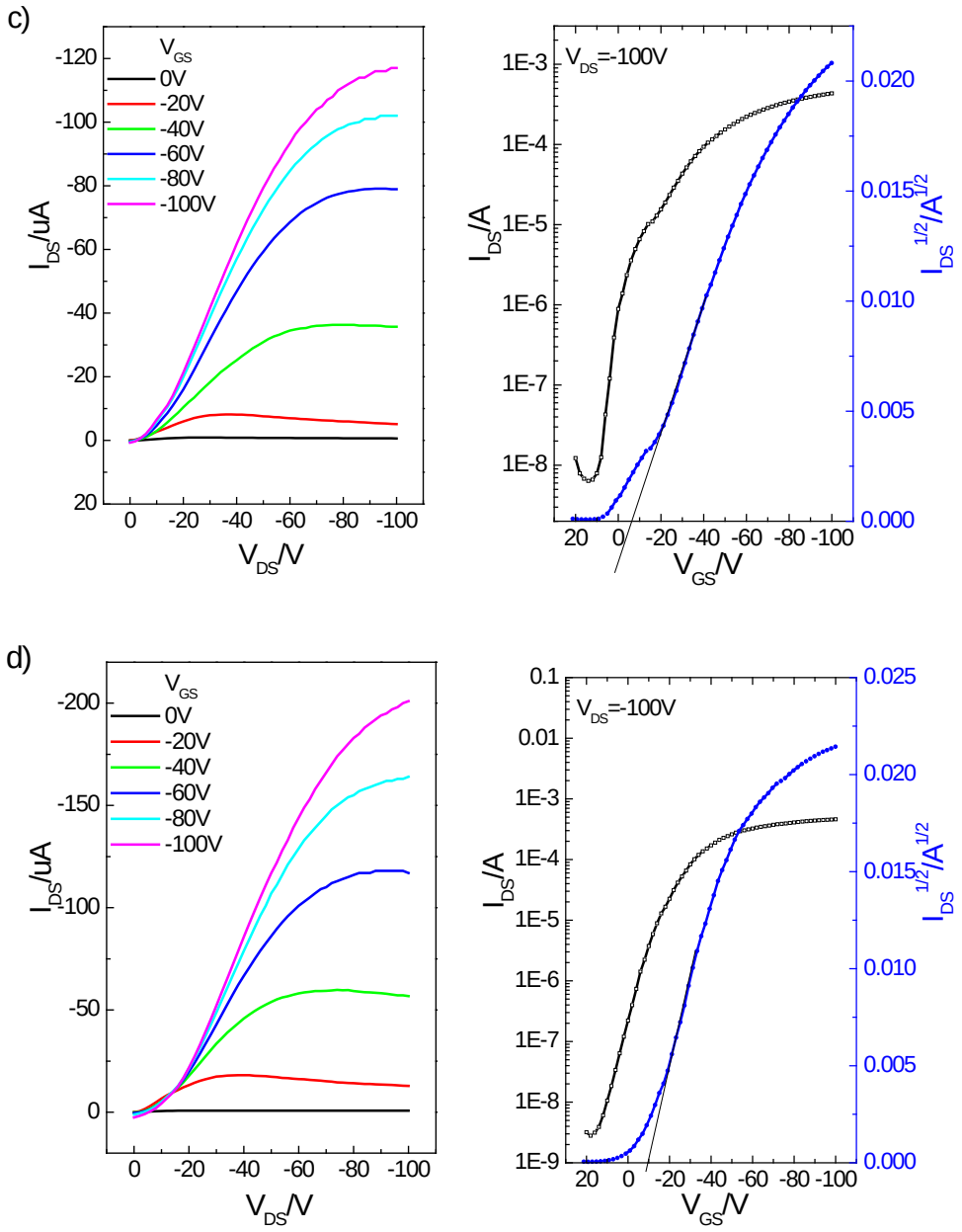

Figure S6. Output (left) and transfer (right) transfer characteristics of hole accumulation regimes of PDBFBT:$PC_{61}BM$ films (D/A = 1/4) annealed at a) 50 °C, b) 100 °C, c) 150 °C, and d) 200 °C. L = 30 µm, W = 1 mm.

Table S1. Crystal size calculation with the Scherrer equation[a] using the primary diffraction peak on the XRD diagrams of PDBFBT:$PC_{61}BM$ films with different D/A ratios annealed at 200 °C (Figure 2).

D/A	2θ (°)	β (°)	τ (nm)
1/0	4.702	0.4206	59
1/1	4.663	0.2837	88
1/2	4.702	0.3175	79
1/3	4.584	0.4931	51
1/4	4.624	0.3964	63

[a] Scherrer equation:

$$\tau = \frac{K\lambda}{\beta \cos\theta}$$

- where τ is the mean size of the ordered (crystalline) domains; K is a dimensionless shape factor (a value of 0.9 is used for the calculation in this study); λ is the X-ray wavelength (0.15406 nm in this study); θ is the diffraction angle; β or $\Delta(2\theta)$ is the full width at half maximum intensity (FWHM).