Supplementary Information (SI) for Journal of Materials Chemistry C.
This journal is © The Royal Society of Chemistry 2025

Supplementary Information

Space charge induced electrofluorochromic behavior for C12-BTBT based thin-film devices

Yuanwei Zhu,*[a] Yihang Jiang,[a] Fenghua Cao,[a] Pengju Wang,[a] Junxin Ke,[a] Jie Liu,[a] Yongjie Nie,[b] Guochang Li,[c] Yanhui Wei,[c] Guanghao Lu,*[ad] and Shengtao Li *[a]

a.State Key Laboratory of Electrical Insulation and Power Equipment, Xi’an Jiaotong University, Xi’an, Shaanxi 710054, China.
b.Electric Power Research Institute, Yunnan Power Gird Co., Ltd., Kunming 650217, China.
c.College of Automation and Electronic Engineering, Qingdao University of Science and Technology, Qingdao 266000, China.
d.Frontier Institute of Science and Technology, Xi’an Jiaotong University, Xi’an, Shaanxi 710054, China.

*Correspondence: E-mail: sli@mail.xjtu.edu.cn, zhuyuanwei@mail.xjtu.edu.cn, guanghao.lu@mail.xjtu.edu.cn

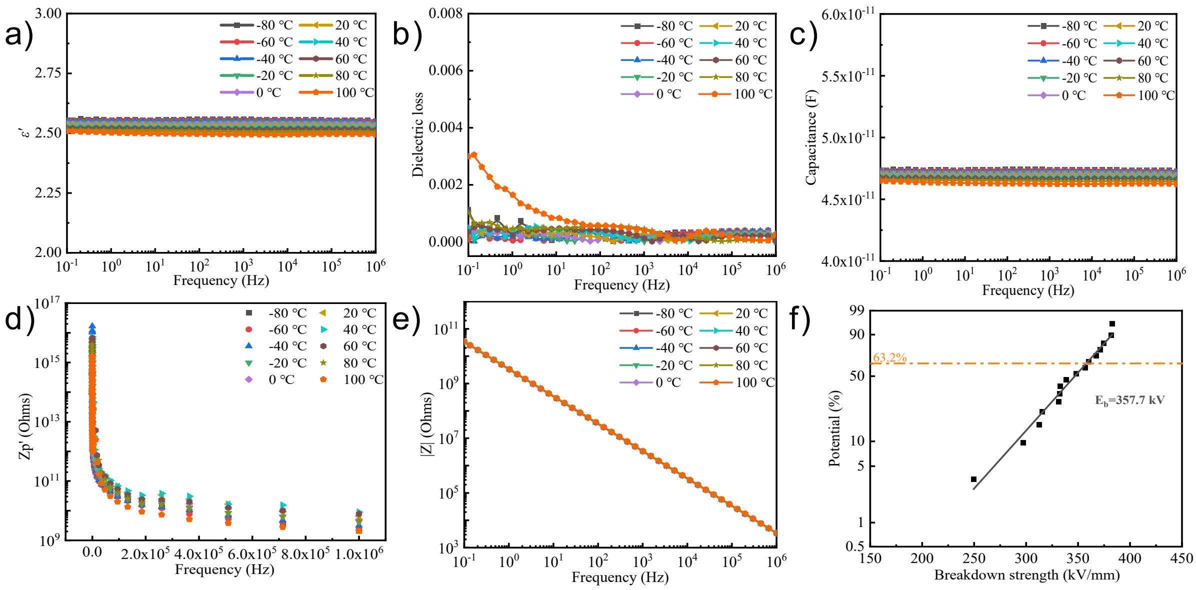

Fig. S1. Dielectric properties of PS. a) dielectric constant, b) dielectric loss(tan δ), c) capacitance, d) impedance Z', e) impedance modulus |Z|, f) breakdown strength.

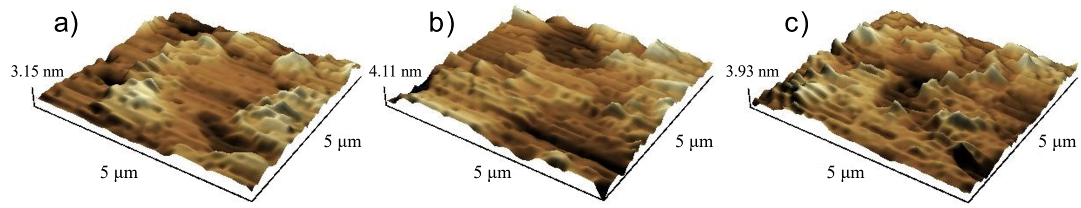

Fig. S2. AFM image of C12-BTBT film with a) no dielectric layer, b) PS as dielectric layer, and c) FPS dielectric layer.

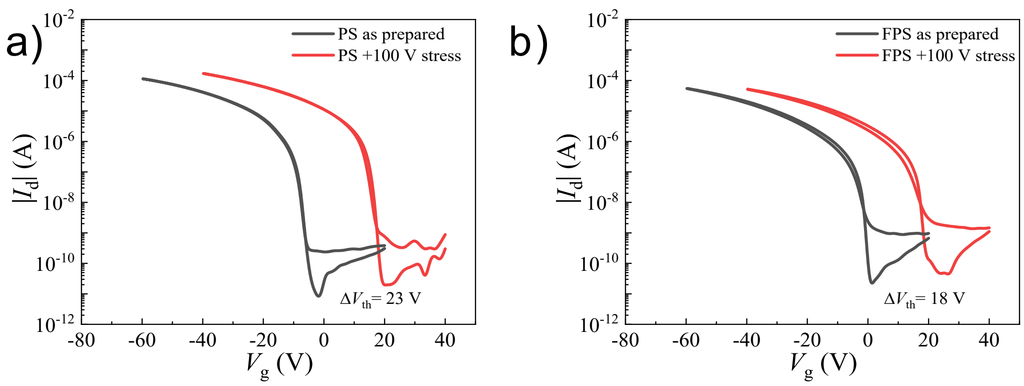

Fig. S3. OFET performance of C12-BTBT/PS and C12-BTBT/FPS. (a) Transfer characteristics of C12-BTBT/PS OFET with +100 V and without pretreatment by gate stress. (b) Transfer characteristics of C12-BTBT/FPS OFET with +100 V and without pretreatment by gate stress.

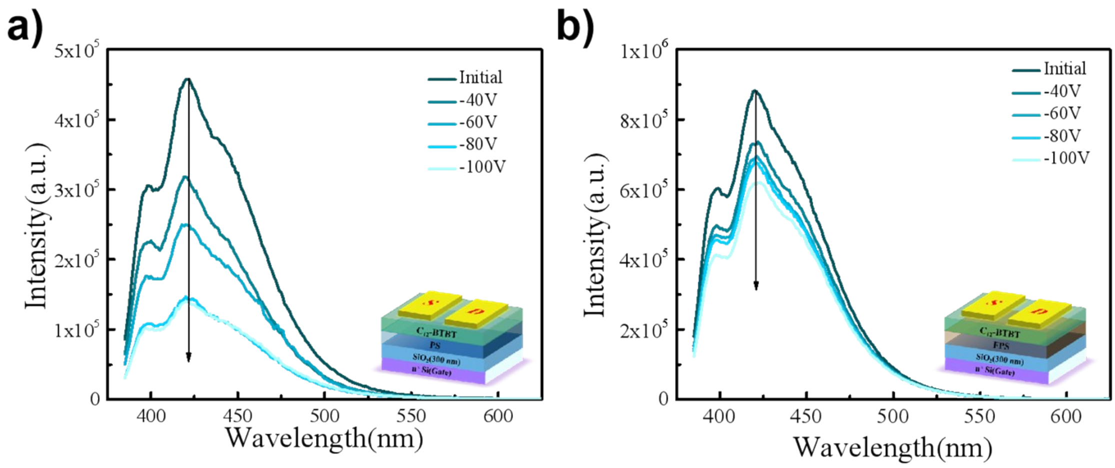

Fig. S4. Fluorescence intensity variation of C12-BTBT devices with different structures under negative electric field. a) Fluorescence intensity variation of devices with PS as dielectric layer at -40 V, -60 V, -80 V and -100 V voltages. b) Fluorescence intensity variation of devices with FPS as dielectric layer at -40 V, -60 V, -80 V and -100 V voltages.

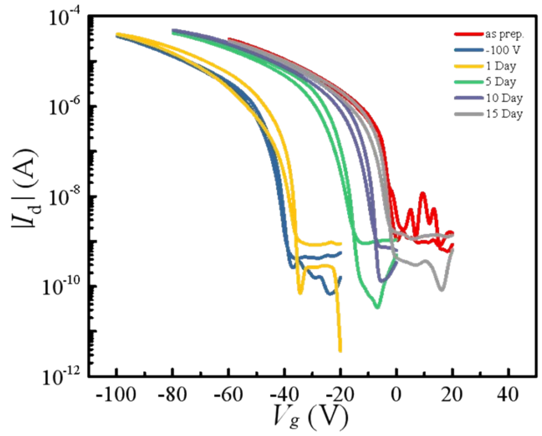

Fig. S5. Ambient stabilities of C12-BTBT/PS OFETs with negative electrets.

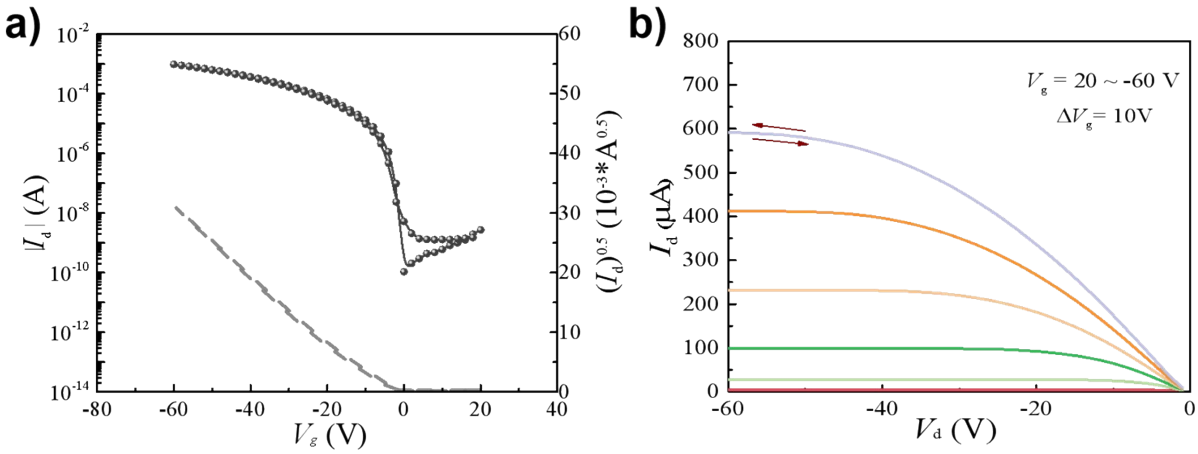

Fig. S6. OFET performances of C12-BTBT/PS. a) Transfer characteristics of C12-BTBT/PS OFET. b) Output characteristics of an as-prepared C12-BTBT/PS OFET.

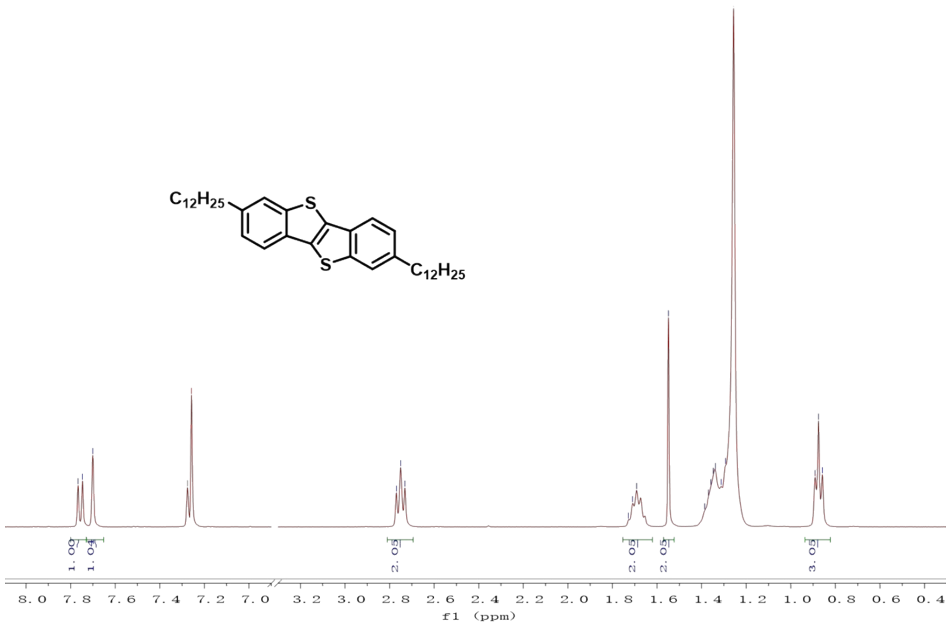

Fig. S7. ^{1}H NMR spectrum of C12-BTBT.

Table S1. Performances of C12-BTBT/PS and C12-BTBT/FPS OFET devices.

	C12-BTBT/PS	C12-BTBT/FPS
μ_{max} ($cm^2s^{-1}V^{-1}$)	10.2	9.8
$\mu_{average}$ ($cm^2s^{-1}V^{-1}$)	9.6	8.7
I_{on}/I_{off} (average)	~2×10^6	~1×10^7
$-V_{th\text{-}average}$ (V)	~20	~15
Δn (cm^{-2})	7.3×10^{12}	4.8×10^{12}

Table S2. Parameters for bottom-gate/top-contact OFET devices based on BTBT. Including maximum and average mobilities, average trap state densities, and threshold voltages.

	μ_{max} ($cm^2s^{-1}V^{-1}$)	$\mu_{average}$ ($cm^2s^{-1}V^{-1}$)	TSD_{avg} ($cm^2s^{-1}V^{-1}$)	$V_{th\text{-}averag}$ (V)	Ref.
Vacuum dep.	1.46	1.36	1.1×10^{13}	14.4	Ref. 30
Drop-cast.	3.59	2.05	7.1×10^{12}	16.5	Ref. 30
Liq.-liq.	2.89	1.49	7.0×10^{12}	17.7	Ref. 30
C12-BTBT	9.1	8.3	4.3×10^{11}	~18	This work
C12-BTBT/PS	10.2	9.6	5.8×10^{11}	~20	This work
C12-BTBT/FPS	9.8	8.7	5.2×10^{11}	~15	This work

Table S3. Performances of representative photodetectors based on organic semiconductors.

Materials	Wavelength (nm)	P	R (AW^{-1})	D* (Jones)	Ref.
C10-BTBTN	266	1.6×10^7	8.4×10^3	7.7×10^{14}	39
P3HT/C3N5	540	-	3.91	4.5×10^{13}	43
CPB QD	365	1.3×10^6	1.2×10^3	10^{14}	44

C8-BTBT (ribbons)	280	8200	44	-	45
Rubrene/Graphene	405	-	8×10^{5}	10^{12}	46
Graphene/BUBD-1	270-850	-	7×10^{5}	4×10^{14}	47
Pentacene/Graphene	658	-	$>10^{4}$	-	48
Graphene/PM6:Y6	450-1064	-	2.8×10^{6}	1.47×10^{14}	49
PPy-NGr/SnO_2	<240		4594.25	6.47×10^{11}	50
C12-BTBT	365	1.9×10^{6}	1.03×10^{4}	1.17×10^{15}	This Work

Video S1.mp4

Video S1. Fluorescence changes of single-layer C12-BTBT device at -100V.

Video S2.mp4

Video S2. Fluorescence changes of electrofluorochromic device at 100V 1Hz.