ADVANCED ELECTRONIC MATERIALS

Supporting Information

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X-ray Detectors With Ultrahigh Sensitivity Employing High Performance Transistors Based on a Fully Organic Small Molecule Semiconductor/Polymer Blend Active Layer

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Table S1. Electrical parameters of OFETs based on films of TMTES and TMTES:PS deposited by BAMS. The parameters are calculated for OFETs with the conducting channel parallel (‖) and perpendicular (⊥) to the coating direction.

Ink formulation	**Speed ($mm\ s^{-1}$)**		**Mobility ($cm^2\ V^{-1}\ s^{-1}$)**	**V_{TH} (V)**	**On/Off**	**μ^{max} ($cm^2\ V^{-1}\ s^{-1}$)**
TMTES	1	‖	$(1.1 \pm 0.3)\cdot 10^{-1}$	(30 ± 10)	10^3	0.19 ± 0.2
		⊥	$(9 \pm 4)\cdot 10^{-2}$	(40 ± 10)	10^3	0.11 ± 0.2
	10	‖	$(1.0 \pm 0.3)\cdot 10^{-1}$	(27 ± 9)	10^3	0.22 ± 0.3
		⊥	$(7.4 \pm 1.9)\cdot 10^{-2}$	(34 ± 9)	10^3	0.10 ± 0.2
TMTES:PS (4:1) PS_{10K}	1	‖	1.2 ± 0.2	2 ± 2	10^4	1.4 ± 0.2
		⊥	0.2 ± 0.1	4 ± 3	10^4	0.4 ± 0.2
	10	‖	1.3 ± 0.3	1 ± 1	10^4	1.6 ± 0.2
		⊥	0.7 ± 0.3	-0.1 ± 0.3	10^4	0.9 ± 0.2
TMTES:PS (4:1) PS_{280K}	1	‖	0.7 ± 0.1	-(2 ± 1)	10^4	0.9 ± 0.2
		⊥	0.4 ± 0.3	-(2.6 ± 0.7)	10^4	0.7 ± 0.2
	10	‖	1.7 ± 0.4	-(0.7 ± 0.2)	10^4	2.3 ± 0.3
		⊥	1.0 ± 0.2	-(0.2 ± 0.6)	10^4	1.5 ± 0.2
TMTES:PS (2:1) PS_{280K}	1	‖	2.4 ± 0.4	-(0.53 ± 0.17)	10^5	3.6 ± 0.4
		⊥	2.0 ± 0.4	-(0.45 ± 0.15)	10^5	2.5 ± 0.3
	10	‖	**2.6 ± 0.6**	**-(1.1 ± 0.2)**	**10^5**	**3.1 ± 0.2**
		⊥	**2.1 ± 0.6**	**-(1.00±0.11)**	**10^5**	**2.8 ± 0.3**
TMTES:PS (1:2) PS_{280K}	1	‖	1.1±0.2	-(0.4 ± 0.8)	10^4	1.6 ± 0.2
		⊥	1.0±0.3	-(0.4 ± 0.3)	10^4	1.4 ± 0.3
	10	‖	0.9±0.2	-(1.0 ± 0.2)	10^4	1.4 ± 0.2
		⊥	0.7±0.3	-(0.9 ± 0.3)	10^4	1.0 ± 0.2

Table S2. Comparison of our results with the electrical transport parameters of solution processed OFETs based on TMTES reported in literature.

OSC Formulation	Scalable to Roll-to-Roll (Deposition Technique)	Binder	μ ($cm^2 \cdot V^{-1} \cdot s^{-1}$)	V_{TH} (V)	Ref
2.0 wt % CB (2:1) PS	YES (Solution Shearing)	YES	2.6±0.6	-1	This work
2.0 wt % CB	YES (Solution Shearing)	NO	0.10±0.03	~30	This work
0.5 wt % TL	NO (Drop casting)	NO	1.3±0.4	NA	1
1.2 wt % TE (1:2) 4-iPrCN-TAA/C8-Flu (70:30)	NO (Spin coating)	YES	4.3±0.3	~10	2
TE	NO (Spin coating)	NO	2.6-3.5	~40	3
1wt % TE	NO (Drop casting)	NO	0.3	~0	4
1 wt% TE (1:1) (iPVN)	NO (Drop casting)	YES	0.07	~0	4
n.r.	NO (Spin coating)	NO	1.9		5

(CB) chlorobenzene, (TL) toluene, (TE) tetralin, (iPVN) isotactic poly(a-vinyl naphthalene and (4-iPrCN-TAA/C8-Flu) 4-isopropylcyano triarylamine/n-octyl Fluorene, 70/30 copolymer. n.r.: not reported.

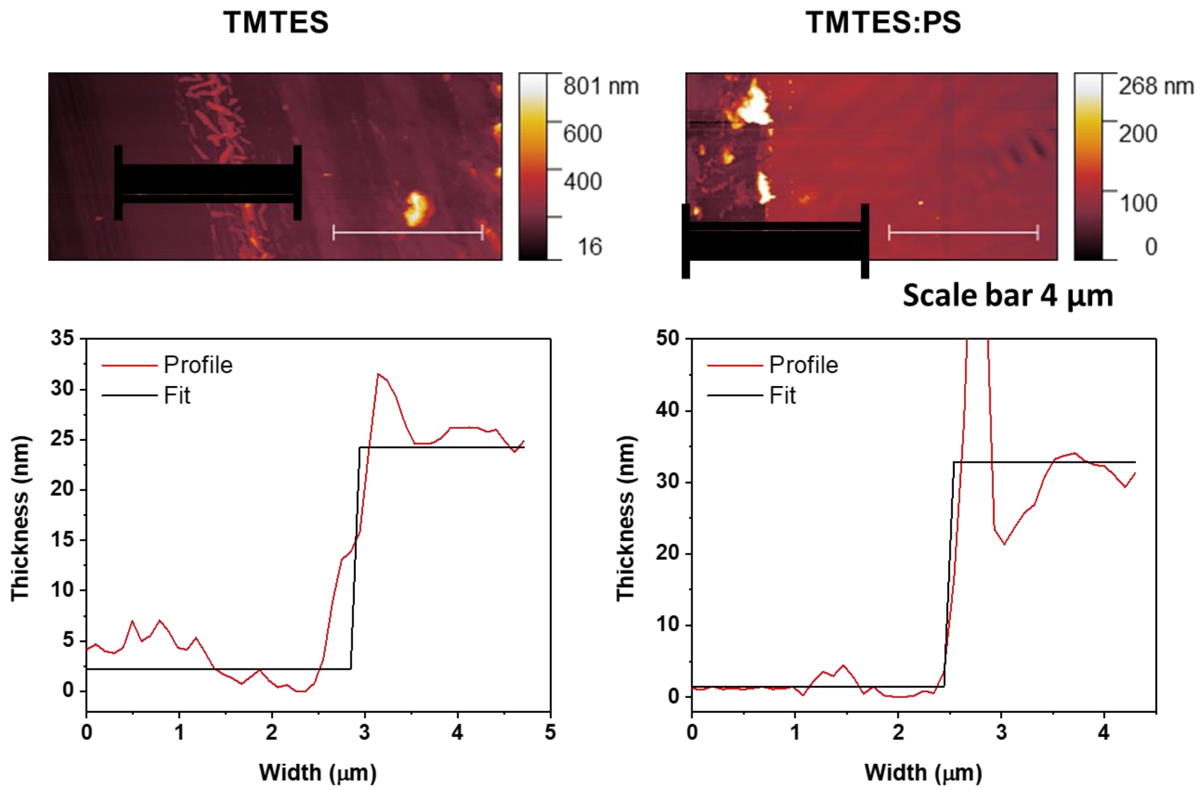

Figure S1. Topographic AFM images (top) and depth profiles (bottom) for thickness estimation of the TMTES and TMTES:PS thin films.

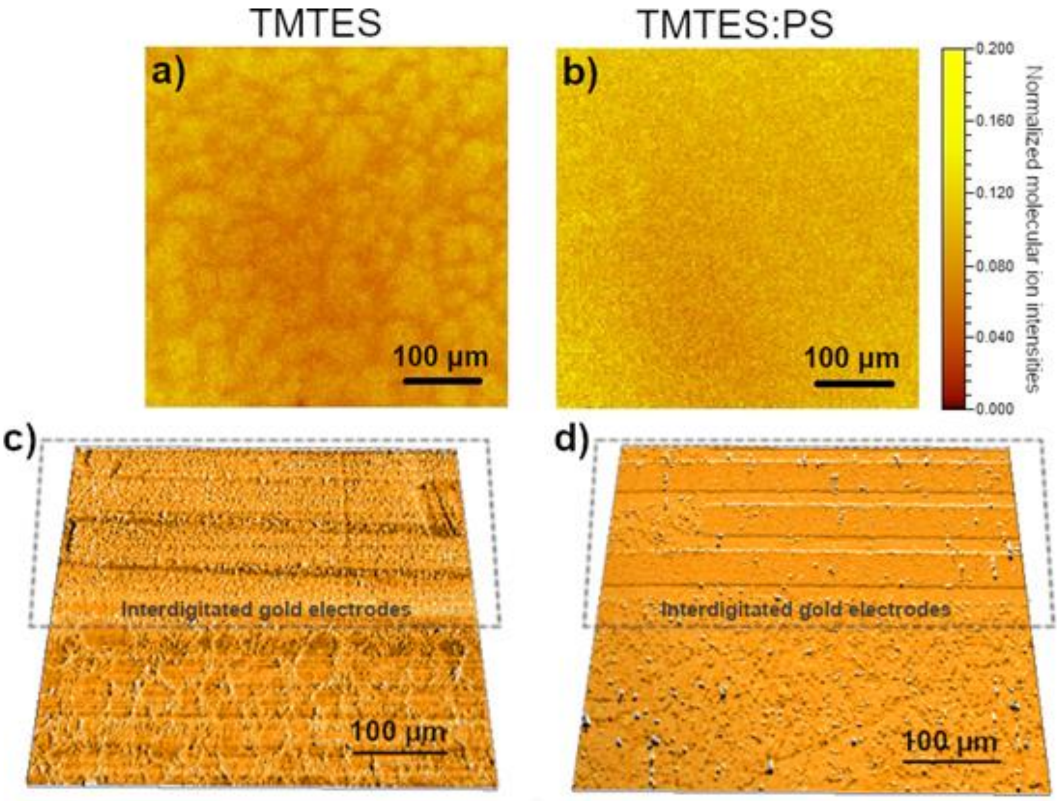

Figure S2. ToF-SIMS 2D surface chemical maps of TMTES and TMTES:PS thin films deposited by BAMS at high coating speed. Normalized (to total counts) sum of $Si_2C_{42}H_{50}^+$ (m/z = 610.34), $Si_2{}^{13}CC_{41}H_{50}^+$ (m/z = 611.35), $Si_2{}^{13}C_2C_{40}H_{50}^+$ (m/z = 612.35), $^{30}SiSi^{13}CC_{41}H_{50}^+$ (m/z=613.34), $^{30}SiSi^{13}C_2C_{40}H_{50}^+$ (m/z = 614.35), and $^{30}SiSi^{13}C_3C_{39}H_{50}^+$ (m/z = 615.35) secondary ion signals from (a) TMTES and (b) TMTES:PS surface acquired outside the interdigitated electrodes. 3D surface height profiles maps of c) TMTES and d) TMTES:PS films with the interdigitated gold electrodes.

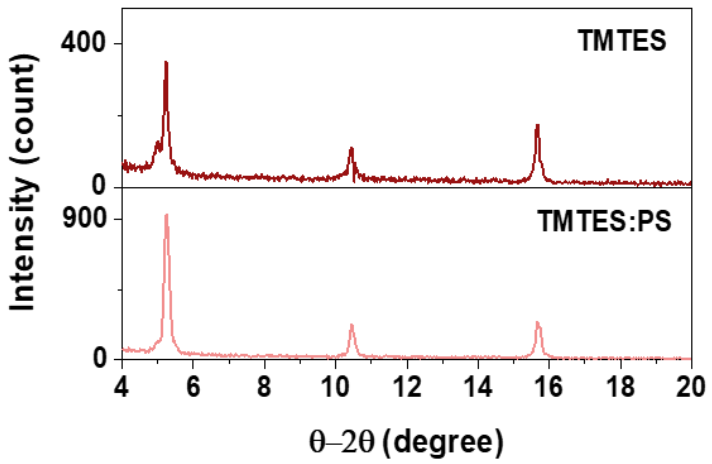

Figure S3. X-ray diffractograms of TMTES and TMTES:PS thin films deposited by BAMS.

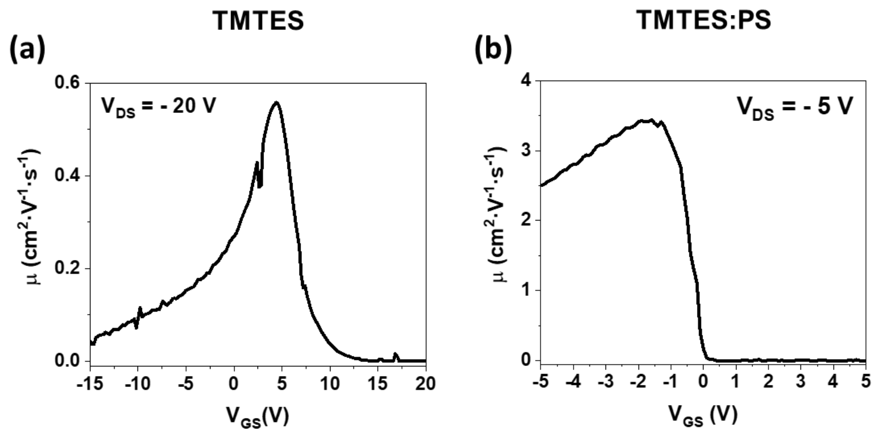

Figure S4. Dependence of charge carrier mobility on the applied gate voltage for OFETs based on (a) TMTES and (b) TMTES:PS.

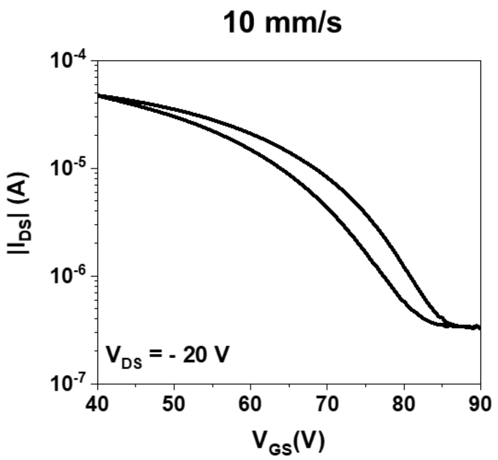

Figure S5. Transfer characteristics in saturation regime of TMTES OFETs measured 90 days after their fabrication

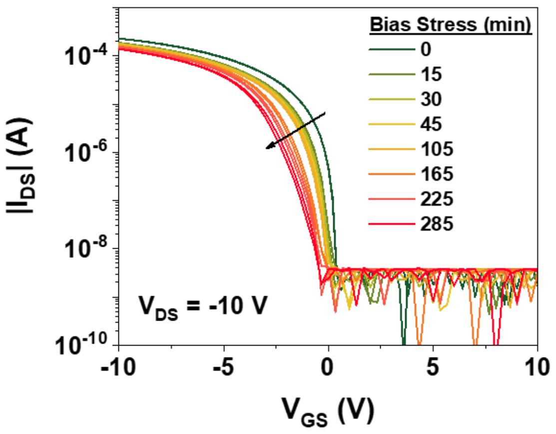

Figure S6. Consecutive transfer characteristics of the films TMTES:PS 2:1 under bias stress (V_{GS}= -10 V and VDS= -1 V).

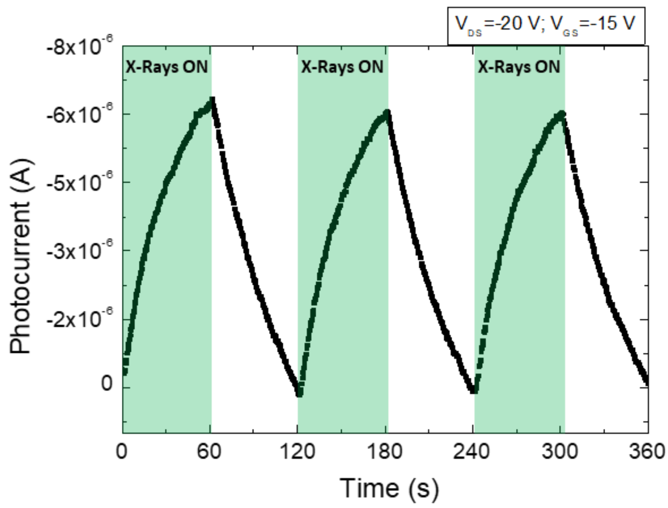

Figure S7. X-ray induced photocurrent response of a TMTES:PS BAMS-coated device upon three on/off switching cycles (green areas correspond to time windows of 60 s) employing a dose rate of 9.8 mGy s^{-1}.

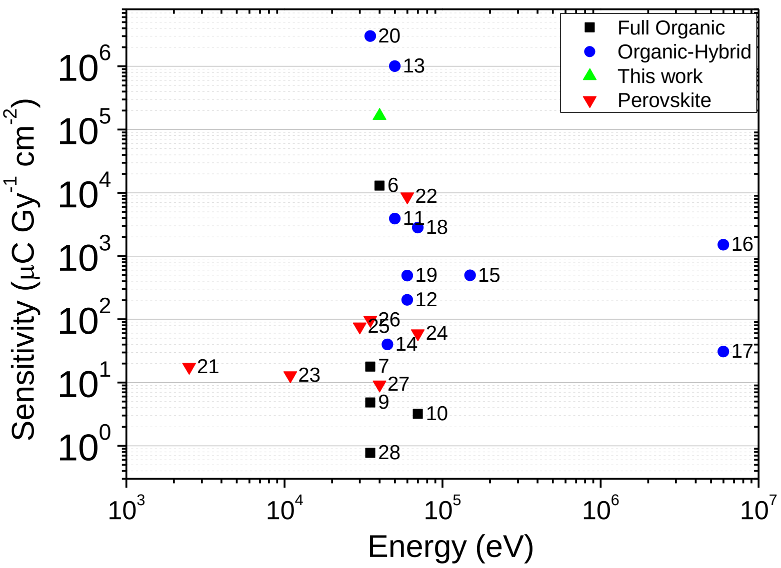

Figure S8. Comparison of the sensitivity values per unit area achieved in this work (green triangle), with those reported at the state of the art for thin-film detectors based on perovskite (red triangles), organic-hybrid (blue circles), and full-organic (black squares) active layers.[6-28]

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