Electronic supplementary information

Transistor application of single crystals of [8]phenacene

Yuma Shimo,[a] Takahiro Mikami,[a] Hiroto T. Murakami,[a] Shino Hamao,[b] Hidenori Goto,[b] Hideki Okamoto,[c] Shin Gohda,[d] Kaori Sato,[d] Antonio Cassinese, [e] Yasuhiko Hayashi[a] and Yoshihiro Kubozono*[b/g]

[a] *Department of Electric and Electronic Engineering, Okayama University, Okayama 700-8530, Japan*

[b] *Research Laboratory for Surface Science, Okayama University, Okayama 700-8530, Japan*

[c] *Department of Chemistry, Okayama University, Okayama 700-8530, Japan*

[d] *NARD Co. Ltd. Amagasaki 660-0805, Japan*

[e] *CNR-SPIN and Department of Physics, University of Naples, Piazzale Tecchio 80, 80125, Naples, Italy*

[f] *Research Centre of New Functional Materials for Energy Production, Storage and Transport, Okayama University, Japan*

[g] *Japan Science and Technology Agency, ACT-C, 4-1-8 Honcho, Kawaguchi, Saitama, 332-0012, Japan*

Contents

1. Lattice constants of phenacene crystals

Table S1 Lattice constants of phenacene crystals.

	a [Å]	*b* [Å]	*c* [Å]	*β* [°]	Ref.
Picene	8.472(2)	6.170(2)	13.538(7)	90.81(4)	[18]
[6]phenacene	12.130(1)	7.9416(7)	15.401(1)	93.161(8)	[16]
[7]phenacene	8.4381(8)	6.1766(6)	17.829(2)	93.19(1)	[16]
[8]phenacene	8.842(2)	6.043(1)	19.896(4)	92.92(3)	

2. FET parameters evaluated for each [8]phenacene single-crystal FET

Table S2 FET parameters of [8]phenacene single-crystal FETs with parylene-coated SiO_2 gate dielectrics.

sample	μ ($cm^2V^{-1}s^{-1}$)	$\lvert V_{th}\rvert$ (V)	ON/OFF	S (V/decade)	L (μm)	W (μm)
#1	1.0	31.3	2.3×10^8	1.4	30	1200
#2	1.0	33.4	1.0×10^6	2.8	30	1900
#3	1.3	19.1	2.1×10^8	4.4	50	200
#4	1.6	26.3	4.4×10^8	4.2	50	500
#5	1.6	31.7	4.7×10^8	1.4	50	600
#6	1.8	29.7	6.2×10^8	3.9	50	700
#7	1.5	27.8	4.5×10^8	4.4	50	600
#8	1.7	38.3	1.2×10^8	0.92	100	1400
#9	2.5	23.2	5.6×10^7	1.3	100	2100
#10	1.7	25.6	1.6×10^7	1.5	100	2300
#11	2.5	27.2	1.1×10^9	0.85	100	2300
#12	1.4	24.9	1.3×10^7	2.0	150	700
#13	8.2	28.1	3.5×10^8	1.6	450	900
#14	3.7	16.9	3.0×10^7	1.2	450	1700
#15	7.2	15.6	6.3×10^7	1.0	450	900
#16	7.5	18.4	3.9×10^7	1.2	450	600
#17	5.4	8.7	4.5×10^7	0.71	450	800
#18	6.0	34.2	4.5×10^7	1.2	450	1200
average	3(2)	26(8)	$2(3)\times10^8$	2(1)		

Table S3 FET parameters of [8]phenacene single-crystal FETs with parylene-coated SiO_2 gate dielectrics, measured in four-terminal mode.

sample	μ ($cm^2V^{-1}s^{-1}$)	$\lvert V_{th}\rvert$ (V)	ON/OFF	S (V/decade)	L (μm)	W (μm)
#1	3.1	62.6	1.37×10^7	1.86	150	1700
#2	7.3	42.6	2.75×10^7	0.934	150	900
#3	6.3	36.0	2.14×10^7	1.14	150	800
average	6(2)	47(14)	$2.1(7)\times10^7$	1.3(5)		

Table S4 FET parameters of [8]phenacene single-crystal FETs with parylene-coated PZT dielectrics.

sample	μ ($cm^2V^{-1}s^{-1}$)	$\lvert V_{th}\rvert$ (V)	ON/OFF	S (V/decade)	L (μm)	W (μm)
#1	2.02	3.5	6.2×10^2	2.8	100	200
#2	1.39	5.0	1.1×10^7	0.69	50	500
#3	2.07	4.9	9.2×10^6	0.40	100	700
#4	1.60	6.1	5.2×10^6	0.51	135	900
#5	1.16	3.8	5.3×10^3	1.8	100	600
average	1.6(4)	5(1)	$5(5)\times10^6$	1(1)		

Table S5 FET parameters of [8]phenacene single-crystal FETs with EDL capacitors.

sample	μ ($cm^2V^{-1}s^{-1}$)	$\lvert V_{th}\rvert$ (V)	ON/OFF	S (V/decade)	L (μm)	W (μm)
#1	2.5×10^{-1}	2.427	2.13×10^{2}	4.8×10^{-1}	97	400
#2	3.5×10^{-1}	2.354	3.79×10^{2}	5.2×10^{-1}	100	800
#3	7.1×10^{-1}	2.366	2.18×10^{7}	8.3×10^{-2}	98	500
average	$4(2)\times10^{-1}$	2.38(4)	$7(13)\times10^{6}$	$4(2)\times10^{-1}$		

3. *L* dependence of μ in [8]phenacene single-crystal FET with SiO_2 gate dielectric

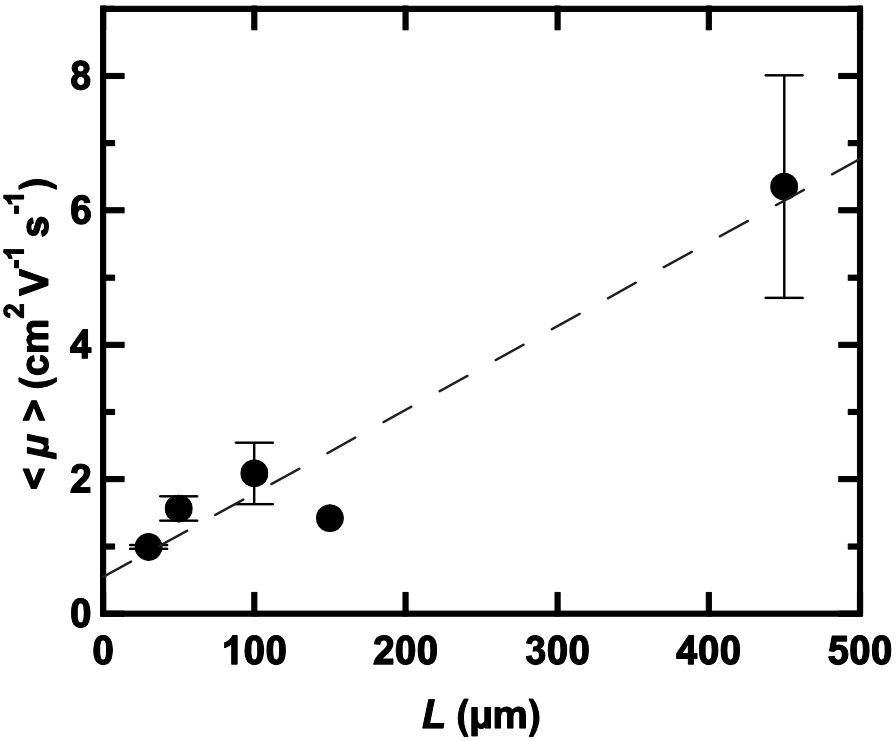

Fig. S1 Plot of $< \mu >$ - *L* for an [8]phenacene single-crystal FET; dashed line represents best linear fit.

4. Transfer and output curves of [8]phenacene single-crystal FET with HMDS-coated SiO_2 gate dielectric

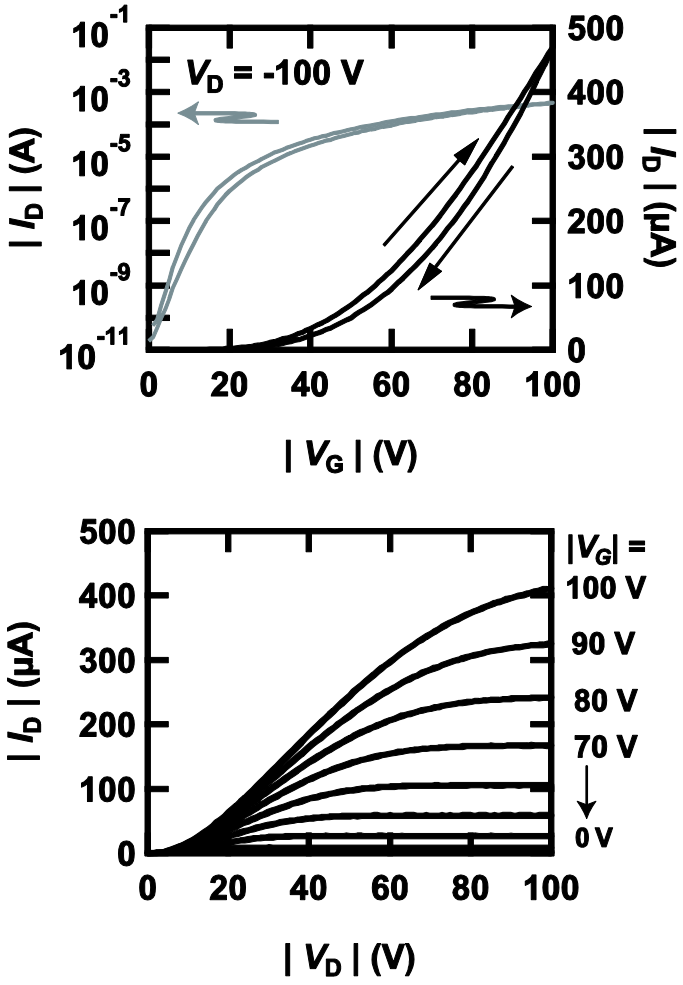

Fig. S2 Transfer (top) and output (bottom) curves of an [8]phenacene single-crystal FET with HMDS-coated SiO_2 gate dielectric.

5. Transfer and output curves of typical PDIF-CN_2 single-crystal FET

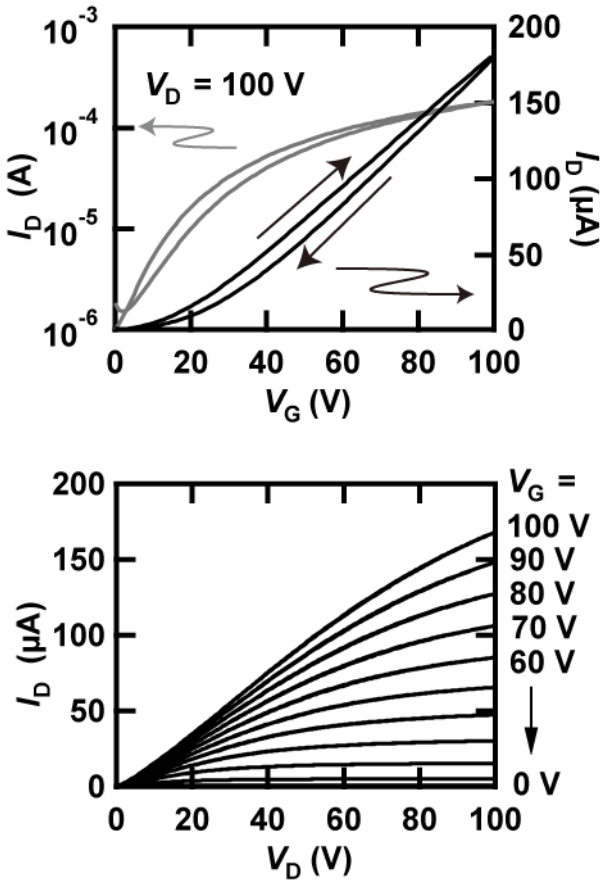

Fig. S3 Transfer (top) and output (bottom) curves of a PDIF-CN_2 single-crystal FET with parylene-coated SiO_2 gate dielectric.