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Supporting Information

Development of fullerenes and their derivatives as semiconductors in field effect transistors: exploring the molecular design

Celebrating 50 years of Professor Fred Wudl's contributions to Organic Semiconductors

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1. Some relative papers based on C_{60}, C_{70}, PCBM and $PC_{71}BM$.

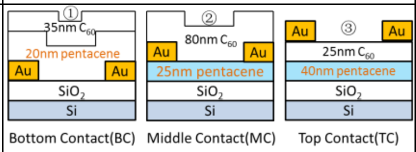
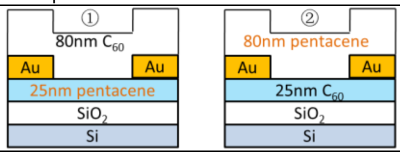
Abbreviation:

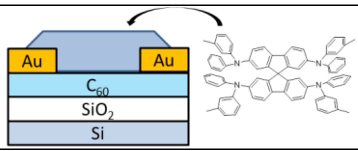
Alq3= tris(8-hydroxyquinoline) aluminum; **BCB**=divinyltetramethyldisiloxane-bis(benzocyclo-butene); **BCP**=bathocuproine; **Bphen**=bathophenanthroline; **b-PS**=polystyrene-based dimethylchlorosilane monolayer; **CB**=chlorobenzene; **CYTOP**=poly(perfluoroalkenyl vinyl ether); **CoTMPP**=5,10,15,20-tetrakis(4-methoxyphenyl) porphyrinato cobalt(II) hybrid nanosheets; **DABT**=4-(dimethylamino)benzenethiol; **DAE**=diarylethene; **DCB**=*o*-Dichlorobenzene; **DIP**=diindenoperylene; **DPTTA**=meso-diphenyltetrathia[22]-annulene[2,1,2,1]; **FP**=fullropyrrodine; **HMDS**=hexamethyldisilazane; **HWE**=hot-wall epitaxy; **NPs**=nanoparticles; **ODCB**=o-dichlorobenzene; **ODPA**=n-octadecylphosphonic acid; **ODS**=octadecyltrimethoxysilane; **ODT**=1-octadecanethiol; **OTS**=octadecyltrichlorosilane; **NW**=nano-whisker; **PAC**=poly(dimethylsiloxane) (PDMS)-assisted crystallization method; **PB-PyDI**=pyromellitic diimide based polymer; **Pc**=phthalocyanine; **PE**=polyethylene; **PEG**=poly(ethylene glycol); **PF**=poly(9,9-dioctyl-fluorenyl-2,7-diyl) end capped with N,N-bis(4-methylphenyl)-4-aniline; **PFBT**=Pentafluorobenzenethiol; **PHDA**=phosphonohexadecanoic acid; **PMMA**=poly(methylmethacrylate); **PPV**=poly(phenylene vinylene); **PS**=polystyrene; **PTCDA**=3,4,9,10-perylenetetracarboxylic dianhydride; **PTmT**=poly(2,5-bis(3'-dodecyl-2,2'-bithiophen-5-yl)-3,6-dimethylthieno[3,2-*b*]thiophene; **PTS**=phenyltrimethoxysilane; **PVA**= poly(vinyl alcohol); **PVP**=poly(4-vinylphenol); **[RuCp*(mes)]$_2$**=ruthenium(pentamethylcyclopentadienyl)(1,3,5,-trimethylbenzene) dimer; **SDS**= sodium dodecyl sulfate; **SU8** =(epoxy photosentive commercial ink); **TCB**=1,2,4-trichlorobenzene; **UHV** =ultrahigh vacuum conditions; **ZSO**=zirconium-silicon oxide

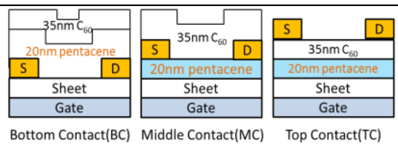
Some relative papers are collected here by year. They are device engineering reports. Some of them are mentioned in the main text. In the main text, Figure 1 is extracted from the mobility presented in the second column in the following tables.

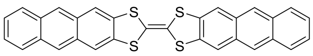
C_{60}

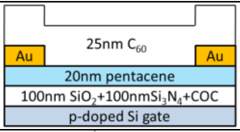
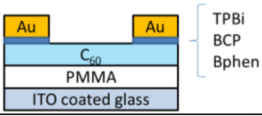
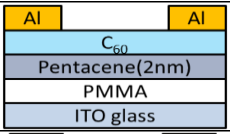
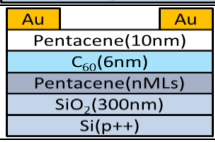
Ref.	Mobility ($cm^2 V^{-1} s^{-1}$)	I_{on}/I_{off}	V_T (V)	Deposition Structure (Measured in)	Title
	1993				
1	Too low to be measured			Evaporating BGBC; Si/SiO_2; Cr/Au Vacuum	Conduction mechanisms in undoped thin films of C_{60} and $C_{60/70}$
2	10^{-4}			Evaporating BGBC; Si/SiO_2; Cr/Au	Fullerene Field-Effect Transistors
3	Undoped: $4×10^{-5}$ In: 0.03 Sb: 0.04			Evaporating BGBC; Si/SiO_2/C_{60}&dopant; Au Vacuum	Semiconductor-like carrier conduction and its field-effect mobility in metal-doped C_{60} thin films
	1995				
4	0.08	10^6		Vacuum deposition BGBC; Si/SiO_2; Au Vacuum	C_{60} thin film transistors

5 6	μ_e=5×10^{-3} μ_h=~4×10^{-3}		40 ~0	Evaporating BGBC; Si/SiO_2/α-hexathienylene/C_{60}; Au Vacuum	①Organic Heterostructure Field-Effect Transistors; ②Organic field-effect bipolar transistors
	1996				
7	4.8×10^{-5}		2.0	Evaporating deposition BGBC; Si/SiO_2; Au	Transport Mechanisms in Evaporated C_{60} Film Evaluated by Means of Field Effect
8	Air: 4×10^{-9} Vacuum: 2×10^{-3}			Vacuum deposition BGBC; Si/SiO_2/insulating/C_{60}; Cr/Au Vacuum or Air	Transport studies in C_{60} and C_{60}/C_{70} thin films using metal-insulator-semiconductor field-effect transistors
	2002				
9	0.1			Vacuum deposition BGBC; Si/SiO_2/C_{60}; Au/Ti Vacuum	Passivation effects of alumina insulating layer on C_{60} thin-film field-effect transistors
	2003				
10	0.56	>10^{8}	17	Vacuum/molecular beam deposition BGBC; Si/SiO_2; Ti/Au or Cr/Au Vacuum	C_{60} thin-film transistors with high field-effect mobility, fabricated by molecular beam deposition
11	0.5-0.3	>10^{8}		Vacuum/molecular beam deposition BGBC; Si/SiO_2; Ti/Au or Cr/Au Vacuum	Fabrication and characterization of C_{60} thin-film transistors with high field-effect mobility
	2004				
12	0.085(linear) 0.22(photopolymerization)			Vacuum deposition BGBC; Si/SiO_2; Cr/Au Vacuum	Accelerated photopolymerization and increased mobility in C_{60} field-effect transistors studied by ultraviolet photoelectron spectroscopy
13	Au: 5.6×10^{-7} (La@C_{82})/Au: 4.8×10^{-5}	10^{3}	17.1	Vacuum deposition BGBC; Au/Si/SiO_2; (La@C_{82})/Au Vacuum	C_{60} field effect transistor with electrodes modified by La@C_{82}
14	Ag: 4.2×10^{-3} Mg/Ag: 0.064	9×10^{3} 1×10^{5}	18.8 18.9	Vacuum deposition BGTC; Si/SiO_2/HMDS; Ag or Mg/Ag Vacuum	C_{60} thin-film transistors with low work-function metal electrodes
15	①Only n-type after annealing ①Only p-type before annealing ②μ_e=1.3×10^{-3} ②μ_h=6.8×10^{-2} ③not mention	7.6×10^{2} 1.3×10^{5}	98 -15		Fabrication of ambipolar field-effect transistor device with heterostructure of C_{60} and pentacene
16	~0.11			Molecular beam deposition generally fabricated Vacuum	Low-glancing-angle x-ray diffraction study on the relationship between crystallinity and properties of C_{60} field effect transistor
	2005				
17	μ_e=2.6×10^{-4}(sat) μ_h=6.4×10^{-4}		59 -82	Vacuum deposition BGBC; Si/SiO_2/SAM; Cr/Au without exposing to air	Ambipolar operation of fullerene field-effect transistors by semiconductor/metal interface modification
18	μ_e=7×10^{-3} μ_h=1.7×10^{-2}		15.6 -2	Vacuum deposition BGTC; Si/SiO_2/pentacene/C_{60}/LiF; Au Atmosphere	Ambipolar organic thin-film transistors using C_{60}/pentacene structure: Characterization of electronic structure and device property
19	①μ_e=5.8×10^{-3} ①μ_h=3.7×10^{-2} ②μ_e=1.9×10^{-3} ②μ_h=3.1×10^{-5}				Fabrication of a logic gate circuit based on ambipolar field-effect transistors with thin films of C_{60} and pentacene
20	①7.1×10^{-3}(lin) ①1.2×10^{-2}(sat) ②4.1×10^{-5}(without) ②1.1×10^{-4}(HMDS)	normally off 160 normally off	7 2 3 -5	thermal deposition ①BGBC; Au/polyimide/HMDS; Au ②BGBC;Si/SiO_2/$Ba_{0.4}Sr_{0.6}Ti_{0.96}O_3$/(HMDS);Au Vacuum	Fabrication of C_{60} field-effect transistors with polyimide and $Ba_{0.4}Sr_{0.6}Ti_{0.96}O_3$ gate insulators
21	μ_e=2×10^{-3}~9×10^{-3} μ_h=8×10^{-5}~3×10^{-4}			Spin-coating/(di)chlorobenzene BGBC; Si/SiO_2/C_{60}&PPV; Ti/Au/cap Vacuum	Facile fabrication method for p/n-type and ambipolar transport polyphenylenevinylene -based thin-film field-effect transistors by blending C_{60} fullerene
22	0h: 0.192 1h in ambient: 0.159 24 h in nitrogen 0.170	1.5×10^{6} 8.3×10^{5} 1.0×10^{6}	29.7 35.6 33.5	Vacuum vapor deposition BGBC; Si/SiO_2; Ti/Au Nitrogen or Air	Fullerene based n-type organic thin-film transistors
23	0.4~1	>10^{4}	-35	HWE BGBC; ITO/BCB/C_{60}; LiF/Al Argon or Helium	High-mobility n-channel organic field-effect transistors based on epitaxially grown C_{60} films
24	0.08 and 0.5(after annealing) oxygen exposure: μ_e=4×10^{-4} μ_h=4×10^{-5}			Molecular-beam deposition BGTC; Si/SiO_2/C_{60}; Cr/Au UHV or oxygen exposure	Ultrapure C_{60} field-effect transistors and the effects of oxygen exposure
	2006				
25	5×10^{-4}(undoped) 0.2(1.8mol% doped)			Vacuum deposition BGBC; Si/SiO_2/C_{60}&acridine orange; Au Vacuum	Acridine orange base as a dopant for n doping of C_{60} thin films
26	~10^{-3}		~70	evaporated deposition BG; Si/SiO_2/C_{60}; Au during film growth	Analysis of transient phenomena of C_{60} field effect transistors

27	μ_e=0.23 μ_h=0.14			Vacuum deposition BGBC; Si/SiO_2/pentacene; Au Nitrogen/ Vacuum/Air	Bottom Contact Ambipolar Organic Thin Film Transistors Based on C_{60}/Pentacene Heterostructure
28	0.02	normally-on	~0	NW from m-xylene/isopropyl alcohol BGBC; Si/SiO_2/C_{60}-NW; Ti/Au Vacuum	Electrical properties of field-effect transistors based on C_{60} nanowhiskers
29	①6 (T_{sub}=250℃) ①3 (T_{sub}=120℃) ①0.6 (T_{sub}=25℃) ②0.2			Channel: HWE ①BGTC; ITO/BCB/C_{60}; LiF/Al ②BGBC; Si/SiO_2/HMDS/C_{60}; Ti/Au Vacuum	High performance n-channel organic field-effect transistors and ring oscillators based on C_{60} fullerene films
30	No pentacene: 0.25~1 With pentacene: 2.0~4.9			Vacuum deposition BGTC; Al/Al_2O_3/(pentacene)/C_{60}; Mg Vacuum	High-Mobility C_{60} Field-Effect Transistors Fabricated on Molecular-Wetting Controlled Substrates
31	0.5~3			Channel: HWE BGTC; ITO/BCB/C_{60}; LiF/Al	Influence of film growth conditions on carrier mobility of hot wall epitaxially grown fullerene based transistors
32	Highest:0.28	7.3×10^6	18	Vacuum deposition BGBC; Si/SiO_2; Au Vacuum	Intrinsic transport and contact resistance effect in C_{60} field-effect transistors
33	μ_e=2.23×10^{-3} μ_h=5.53×10^{-4}		50.2 -37.1		Organic heterostructure field-effect transistors using C_{60} and amorphous spirolinked compound
34	Eu: 0.5 Cu: 2.3×10^{-4} Pt: 2.4×10^{-2}	Normally-on Normally-off Normally-off	34	thermal deposition BGTC; Si/SiO_2/HMDS; Eu or Cu or Pt Vacuum	Output properties of C_{60} field-effect transistor device with Eu source/drain electrodes
35	0.03			Patterning BC; Si/SiO_2/PVP; Cr/Au Vacuum	Patterning organic single-crystal transistor arrays
36	~0.6			Channel: HWE BGTC; ITO/BCB/C_{60}; LiF/Al	Switching in C_{60}-fullerene based field effect transistors
	2007				
37	C_{60}: μ_e=0.32(sat) C_{60}&CuPc: μ_e=2.2×10^{-2}~3.1×10^{-4} C_{60}&CuPc: μ_h=1.6×10^{-6}~1.0×10^{-4}		60.4 44.8~30.7 -24.0~-1.7	thermal evaporation ring-type; Si/SiO_2/C_{60}(&CuPc); Ti/Au Vacuum	Ambipolar charge carrier transport in mixed organic layers of phthalocyanine and fullerene
38	0.074(nonpolymerized) 0.068(polymerized)		19	Vacuum deposition BCTC; Si/SiO_2; Au dry box	C_{60} field-effect transistors: Effects of polymerization on electronic properties and device performance
39 40	6 (T_{sub}=250℃) 3 (T_{sub}=120℃) 0.6 (T_{sub}=25℃) Note: data is similar to Ref. [29]	10^6		HWE BGTC; ITO/BCB/C_{60}; LiF/Al glove box	①Characterization of highly crystalline C_{60} thin films and their field-effect mobility; ②Correlation of crystalline and structural properties of C_{60} thin films grown at various temperature with charge carrier mobility
41	Untreated: 2.8×10^{-3}~6.6×10^{-7} OTS: 1.7×10^{-2}~6.1×10^{-5}	10^3~10^5 10^4~10^6	42~82 60~76	Thermally evaporated BGBC; Si/SiO_2/(OTS); Cr/Au Helium or Air	Estimation of electron traps in carbon-60 field-effect transistors by a thermally stimulated current technique
42	0.02		45	Thermally evaporated BGBC; Cr/PMMA; Au or Al in air	Fullerene thin-film transistors fabricated on polymeric gate dielectric
43	1	10^5(at 5V)	1.13	Thermally evaporated BGTC; Ti-Si/SiO_2/$TiSiO_2$/SiO_2/C_{60}, LiF/Al Nitrogen	High performance n -channel thin-film transistors with an amorphous phase C_{60} film on plastic substrate
44	buffer layer BCB: 3.1±0.2 (Max:5.0) PS: 2.1±0.1 PMMA: 1.1±0.1 OTS: 1.2±0.1	1×10^7 6×10^6 6×10^6 2×10^6	-0.1±0.4 1.2±1.3 2.1±0.4 1.8±0.6	Thermally evaporated BGTC; /Si/SiO_2/buffer layer/C_{60}; Al Nitrogen	High-performance and electrically stable C_{60} organic field-effect transistors
45	UV ozone: 0.061 HMDS: 1.04 ODS: 1.46	2×10^4 1×10^6 2×10^6	3.3 1.7 1.9	Thermally evaporated BGTC; TiSi/SiO_2/ZSO/SiO_2/(SAM)/C_{60}; LiF/Al Nitrogen	High-performance fullerene C_{60} thin-film transistors operating at low voltages
46	polymer dielectrics PVP: 0.27 PMMA: 0.66	1.6×10^5 3.9×10^5	2 5.5	Thermally evaporated BGTC; ITO/polymer dielectrics/C_{60}; Ba/Al Nitrogen	Influence of polymer dielectrics on C_{60} -based field-effect transistors
47	0.68	1×10^6	0.80	Thermally evaporated BGTC; TiSi/SiO_2/TiSiO/SiO_2/HMDS; Au Nitrogen	Low-voltage-operating complementary inverters with C_{60} and pentacene transistors on glass substrates
48	5.9×10^{-3}	normally-off	38	Thermally evaporated BGBC; Si/SiO_2;1-Alkanethiols/Cr/Au Vacuum	Output Properties of C_{60} Field-Effect Transistors with Au Electrodes Modified by 1-Alkanethiols
49	ITO: 0.16 Au: 0.096 Pt: 0.14	4.0×10^6 2.5×10^6 3.3×10^6	36 42 41	Thermally evaporated BGBC; Si/SiO_2/C_{60}; ITO or Au or Pt Vacuum	Output properties of C_{60} field-effect transistors with different source/drain electrodes
	2008				
50	0.07		63	Thermally evaporated BGBC; Si/SiO_2/OTS; Au Vacuum	Ambipolar charge carrier transport in organic semiconductor blends of phthalocyanine and fullerene

51	6.8×10^{-2}			Thermally evaporated BGBC; Si/SiO_2; Au Vacuum	Bipolar transport in organic field-effect transistors: organic semiconductor blends versus contact modification
52	3.23-0.68	4×10^6~8×10^6	17.1~11.8	Thermally evaporated BGBC; Si/SiO_2/HMDS; Au Nitrogen	Bottom-contact fullerene C_{60} thin-film transistors with high field-effect mobilities
53	Best: 0.41	~10^7		Thermally evaporated BGTC; Au/Cr/Si/SiO_2/parylene/C_{60}; Au Helium	High-performance C_{60} thin-film field-effect transistors with parylene gate insulator
54 55	① Al(W/L=10): 1.7±0.1 Al(W/L=80): 1.4±0.05 Highest:4.3(W=L=200μm, Ca) ①② Ca(W/L=10): 2.3±0.2 Ca(W/L=80): 2.3±0.1	$(0.4\pm0.1)\times10^6$ $(1.0\pm0.2)\times10^6$ $(1.0\pm0.3)\times10^6$ $(4.0\pm0.3)\times10^6$	0.3±0.1 0.2±0.1 0.2±0.1 0.1±0.1	Thermally Vacuum evaporated ① BGTC; Au/Ti/Si/SiO_2/Al_2O_3/BCB/C_{60}; Al or Ca ② BGTC; Si/SiO_2/Al_2O_3/BCB/C_{60}; Ca Nitrogen	①High-performance C_{60} n-channel organic field-effect transistors through optimization of interfaces; ②Low-voltage C_{60} organic field-effect transistors with high mobility and low contact resistance
56	HfO_2/ODPA: 0.28(sat) HfO_2: 0.097(sat)	10^5 10^3	0.35 0.40	Vacuum deposition BGTC; Si/HfO_2/(ODPA); LiF/Al Vacuum	Low-voltage high-performance C_{60} thin film transistors via low-surface-energy phosphonic acid monolayer/hafnium oxide hybrid dielectric
57	0.061 PTS: 1.22 HMDS: 1.04 ODS: 1.46	10^6	1.9	Vacuum deposition BGTC; Ti-Si/Si/SiO_2/ZSO/SiO_2/insulator; LiF/Al Nitrogen	Low-voltage-operating fullerene C_{60} thin-film transistors with various surface treatments
58	Linear: 0.14 (highest) Sat: 0.26 (highest)	2.9×10^7 1×10^7	33 32.9	Vacuum deposition BGBC; Si/SiO_2; Ti/Au Vacuum	Potential barriers to electron carriers in C_{60} field-effect transistors
59	0.05~0.15			BGBC/TC; Si/SiO_2/$C_{12}H_{25}SH$; Cr/Au Vacuum	Transport properties in C_{60} field-effect transistor with a single Schottky barrier
60	0.15~0.55		0.2~4	Vacuum deposition BGBC; Al/ITO/polyaniline; Al Nitrogen	Vacuum-Processed Polyaniline–C_{60} Organic Field Effect Transistors
	2009				
61	μ_e=0.04(sat) μ_h=0.2(sat)		66 2.3	Vacuum deposition BGTC;Si/SiO_2/OTS/pentacene/C_{60}/pentacene;Au Nitrogen	Ambipolar pentacene/C_{60}-based field-effect transistors with high hole and electron mobilities in ambient atmosphere
62	1.12-0.86(sat)		8.6-5.9	Vacuum deposition BGTC; Al_9Si_1/SiO_2/HMDS; $Au_{0.9}Ni_{0.1}$/Au Nitrogen	Current-gain cutoff frequencies above 10 MHz for organic thin-film transistors with high mobility and low parasitic capacitance
63	spin-cast :4.7±0.41 vapor: 0.27±0.15 (Highest: 5.3)	$(3.5\pm1.2)\times10^7$ $(7.5\pm6.3)\times10^5$	35.6±6.33 39.8±7.5	Vacuum /OTS by spin-cast or vapor BGTC; Si/SiO_2/OTS; Au Nitrogen	Crystalline Ultrasmooth Self-Assembled Monolayers of Alkylsilanes for Organic Field-Effect Transistors
64	~6		~11	HWE BGTC; ITO/BCB; LiF/Al Vacuum	Electrical response of highly ordered organic thin film metal-insulator-semiconductor devices
65	Ca/Al:0.22 Al:0.21 Au:0.035	5×10^5	-3 0.7 22	Spin-cast/trichlorobenzene(1 wt%) BGTC; ITO/PVP; Al or Ca or Au Nitrogen	Flexible Fullerene Field-Effect Transistors Fabricated Through Solution Processing
66	Highest: 0.05	~10^3	20	Liquid-liquid interface precipitation BGBC; Si/SiO_2; Au/Ti Vacuum	Field-effect-transistor characteristics of solvate C_{60} fullerene nanowhiskers
67	0.1-0.3			Thermally deposition BGTC; Al/ITO/melamine/C_{60}; Al Nitrogen	Small-molecule vacuum processed melamine-C_{60}, organic field-effect transistors
68	μ_{lin}=0.0033~1.3 μ_{sat} =2.5~2.8	4×10^5~5×10^7	5.1~16.8	Vacuum deposition BGTC;Si/SiO_2/HMDS/;benzenethiol/Ni-Au/Au Nitrogen	Threshold voltage control of bottom-contact n-channel organic thin-film transistors using modified drain/source electrodes
	2010				
69	6.5(lin)			HWE BGTC; ITO/BCB/C_{60}; LiF/Al glove box	Dependence of Meyer–Neldel energy on energetic disorder in organic field effect transistors
70	3.2×10^{-2}(pristine) 5.2×10^{-4}(supersonic wave) 2.4×10^{-3}(ultraviolet light)	~10 ~1000 ~10		NW from m-xylene/isopropyl alcohol BGBC; Si/SiO_2/C_{60}-NW; Ti/Au Vacuum or air(working)	Electron Transport Properties in Photo and Supersonic Wave Irradiated C_{60} Fullerene Nano-Whisker Field-Effect Transistors
71	Lactose:0.055 Glucose:0.085 Guanine:0.12 Cytosine:0.09 Adenine:5.5(HWE) Thymine:0.5			Thermally deposition BGTC; Al/Dielectric/C_{60}; Al or Au	Environmentally sustainable organic field effect transistors
72	BC: $\mu_e=5.28\times10^{-3}$ BC: $\mu_h=4.2\times10^{-2}$ MC: $\mu_e=5.5\times10^{-2}$ MC: $\mu_h=5.45\times10^{-2}$ TC: $\mu_e=2.44\times10^{-2}$ TC: $\mu_h=4.5\times10^{-3}$		79 14.5 73 -4.3 68.5 -30	 OSCs are deposited by thermal evaporation, test atmosphere is controlled with 0.1 ppm O_2, Poly(3,4-ethylene dioxythiophene):Poly(styrenesulfonate) (PEDOT:PSS) acts as Gate and Source/Drain electrodes.	Influence of device geometry in the electrical behavior of all organic ambipolar field effect transistors

73	Ba: 1.15 Al: 0.97 Au: 0.126	3.2×10^5 2.8×10^5 6.7×10^4	29 30 36	Thermally deposition BGTC; ITO/polystyrene/C_{60};Ba/Al or Al or Au Nitrogen	Properties of C_{60} thin film transistor based on polystyrene
	2011				
74	100℃: ~1 250℃: ~5			Thermally deposition BGBC; ITO/BCB; LiF/Al	Electric field and grain size dependence of Meyer–Neldel energy in C_{60} films
75	0nm Alq3: 1.71×10^{-3} 5nm Alq3: 1.12×10^{-2} 10nm Alq3: 1.28×10^{-2} 15nm Alq3: 1.88×10^{-3}	10^4 10^2 10^2 10^2	18 11 10 21	thermally evaporated BGTC; Si/SiO_2/PMMA/C_{60}/Alq3; Al Ar atmosphere	Enhanced performance of C_{60} organic field effect transistors using a tris(8-hydroxyquinoline) aluminum buffer layer
76	BCB: 5.1 Parylene: 0.046 AlO_x –BCB: 3.5 AlO_x –PE: 2.9 AlO_x –Adenine: 3.2	$>10^6$ $\sim10^{2.5}$ $\sim10^{2.5}$ $>10^3$ $\sim10^3$	13.2 -3.5 -0.003 0.39 -0.25	Channel: HWE BGTC; Al/BCB; Al TGBC; Al/Parylene-C; Al BGTC; Al/AlO_x/BCB or PE or Adenine; Al Nitrogen	High mobility, low voltage operating C_{60} based n-type organic field effect transistors
77	Ag: 2.74 LiF/Ag: 5.07			Thermally deposition BGTC; ITO/PMMA/pentacene/C_{60}; (LiF)/Ag Nitrogen	Mobility Improvement in C_{60}-Based Field-Effect Transistors Using LiF/Ag Source/Drain Electrodes
78	Solution: 0.6~0.8(highest:0.86) Vacuum: 0.7~0.9	(4×10^6)	(3)	Drop cast and dry/Vacuum deposition BGTC; Si/SiO_2/PTS; LiF/Al Nitrogen	Novel Solution Process for High-Mobility C_{60} Fullerene Field-Effect Transistors
79	1.5 0.0012 0.005			evaporation BGTC; Si/SiO_2/OTS/C_{60}; Au BGTC; Si/SiO_2/OTS/DATTF/C_{60}; Au BGBC; Si/SiO_2/OTS/C_{60}; DATTF/C_{60} BGBC; Si/SiO_2/OTS/C_{60}; DATTF  dianthratetrathiafulvalene (DATTF)	Organic Electrodes Consisting of Dianthratetrathiafulvalene and Fullerene and Their Application in Organic Field Effect Transistors
	2012				
80	4.02 ± 0.35	$(4.68\pm1.04)\times10^6$		Vacuum deposition BGTC; Si/SiO_2, BCB; Au Nitrogen	2-(2-Methoxyphenyl)-1,3-dimethyl-1H-benzoimidazol-3-ium Iodide as a New Air-Stable n-Type Dopant for Vacuum-Processed Organic Semiconductor Thin Films
81	Only C_{60}: 0.38 C_{60}/Bphen: 0.50 Pentacene/C_{60}: 4.11 Pentacene/C_{60}/Bphen: 5.17	4.4×10^3 3.1×10^3 19.5 25	13 11 13 12.5	Thermal evaporation BGTC; ITO/PMMA/pentacene/C_{60}; Bphen/Ag Nitrogen	A high mobility C_{60} field-effect transistor with an ultrathin pentacene passivation layer and bathophenanthroline/metal bilayer electrodes
82	0.17±0.02~0.11±0.02		1.4±0.1~3.8±0.1	Vacuum deposition BGTC; Si/SiO_2/HMDS; Au Nitrogen	Direct structuring of C_{60} thin film transistors by photo-lithography under ambient conditions
83	Ti: 1.94 Ti/Pt: 2.09	0.61×10^6 1.69×10^6	0.51 1.01	Thermal evaporation BGTC; Ti/(Pt)/Si/SiO_2/AlO_x/SAM; Au Nitrogen	Engineering the metal gate electrode for controlling the threshold voltage of organic transistors
84	10^{-5} (μ_e) 10^{-6} (μ_h)			Droping BGBC;Si/SiO_2/HMDS/C_{60}&CoTMPP; Au Nitrogen	Fullerene/Cobalt Porphyrin Hybrid Nanosheets with Ambipolar Charge Transporting Characteristics
85	Needles:5.2±2.1(average) ~11 (highest) Ribbons:3.0±0.87(average)	$>10^5$ $>10^6$	15~43 36~85	Solution Grown (Single Crystals) BGTC; Si /SiO_2/BCB/C_{60}; Au Nitrogen	High-Mobility Field-Effect Transistors from Large-Area Solution-Grown Aligned C_{60} Single Crystals
86	Highest: 0.081	$>10^4$		Drop-casting or dip-coating deposition BGBC; Si /SiO_2/C_{60}; Cr/Au Nitrogen	On the fabrication of crystalline C_{60} nanorod transistors from solution
87	0.4	6×10^4	2.8	Vacuum deposition BGTC; Si/SiO_2/CYTOP; Al Nitrogen	Organic nonvolatile memory transistors based on fullerene and an electron-trapping polymer
88	Unpurified C_{60}: No dopant: 0.38±0.02 Dopant: 0.48±0.03~0.67±0.02 purified C_{60}: No dopant: 1.62±0.03 Dopant: 1.3±0.1~1.73±0.02	 1×10^6 1×10^5-1×10^6 3×10^6 70-3×10^6	 17.9±0.8 4.7±0.6~15±1 4.7±0.3 -0.4±0.9~4.7±0.3	Evaporation or co-evaporation with dopant of [RuCp*(mes)]$_2$ BGTC; Si/SiO_2/BCB/C_{60}(&Dopant); Al Nitrogen	Passivation of trap states in unpurified and purified C_{60} and the influence on organic field-effect transistor performance
89	1.4			drop-casted to solution patterning SAM BGTC; Si/SiO_2/PTS; LiF/Al	Solution-Processed C_{60} Single-Crystal Field-Effect Transistors
90	Chlorobenzene:0.16 m-Xylene:0.083 Tetrahydronaphtalene:0.18 1,2,4-Trichlorobenzene: 0.86	1.2×10^6 1.1×10^6 3.6×10^5 3.9×10^6	5.2 3.6 5.3 1.5	Vacuum-drying from various solvents BGTC; Si/SiO_2/HMDS; LiF/Al Nitrogen	Solvent Dependence of Vacuum-Dried C_{60} Thin-Film Transistors
91	0.58	10^5	-0.1	HWE TGBC; Al/Parylene-C/C_{60}; Al Nitrogen	Strain induced anisotropic effect on electron mobility in C_{60} based organic field effect transistors
	2013				
92	0.08±0.01(sat) 0.05±0.01(lin)		1.2±0.08	Evaporation deposition BGTC; Al/Al_2O_3/cellulose/C_{60}; Al Glove box	Cellulose as biodegradable high-k dielectric layer in organic complementary inverters

93	μ_e=0.18 μ_h=0.28				Dual Channel Operation Upon n-Channel Percolation in a Pentacene-C_{60} Ambipolar Organic Thin Film Transistor
94	No buffer:0.19 TPBi:0.25 BCP:0.52 Bphen:0.65	0.14×10^5 0.34×10^5 0.66×10^5 1.25×10^5	35 26 27 25		Effect of organic buffer layers on the performance of n-type organic field-effect transistor based on C_{60} active layer
95	No Pentacene: 0.213 Pentacene (2nm): 1.01	10^3 10^4	3 11		Enhanced performance of C_{60} N-type organic field-effect transistors using a pentacene passivation layer
96	μ_e=2.8 μ_h=0.3				Enhancing crystallinity of C_{60} layer by thickness-control of underneath pentacene layer for high mobility C_{60}/pentacene ambipolar transistors
97	Cocrystals of C_{60}–DPTTA μ_e=0.01 μ_h=0.3			Drop-casting/chlorobenzene BGTC; Si/SiO_2; Au Vacuum	Fullerene/Sulfur-Bridged Annulene Cocrystals: Two-Dimensional Segregated Heterojunctions with Ambipolar Transport Properties and Photoresponsivity
98	2.4-2.2	10^7~10^8	0.4~0.6	Inkjet-printing and vacuum drying / TCB TC; Si/SiO_2/CYCLOTENE; Al or Au or Ag	High performance inkjet-printed C_{60} fullerene thin-film transistors: Toward a low-cost and reproducible solution process
99	3.3×10^{-6}(dark); 1.5×10^{-4}(illumination) 7.2×10^{-5}(dark); 1.4×10^{-3}(illumination) 2.8×10^{-3}(dark); ----------(illumination)			evaporated BCTC; Si/SiO_2/PdPc/C_{60}; Au BCTC; Si/SiO_2/C_{60}/PdPc; Au BCTC; Si/SiO_2/C_{60}; Au Vacuum with or without illumination	Influence of donor-acceptor layer sequence on photoresponsive organic field-effect transistors based on palladium phthalocyanine and C_{60}
100	1 day: 1.110 14 days: 0.669	10^3 10^4	0 7	Thermally evaporated BGTC;Al/Aloe vera + 1.5wt%SiO_2NPs/C_{60}; Al Exposure to open air	N-Type Organic Field-Effect Transistor Based on Fullerene with Natural Aloe Vera/SiO_2 Nanoparticles as Gate Dielectric
101	Al: 1.82(highest) dimer/Al: 2.23(highest)	1×10^6 2×10^6	4.6 5.0	Thermally evaporated BGTC; Si/SiO_2/BCB; (rhodocene dimer)/Al Nitrogen	Reduction of contact resistance by selective contact doping in fullerene n-channel organic field-effect transistors
102	As-grown: 3.0 (±2.9)$\times10^{-1}$ (Heighest: 1.01) Photo-exposed:4.7(±3.9)$\times10^{-3}$	10^{-4} 10^{-3}	21.5(± 3.8) 20.4(±5.5)	Drop-casting/ nanorods in m-DCB + ethanol BGBC; Si/SiO_2/C_{60}; Cr/Au Nitrogen	Solution-Based Phototransformation of C_{60} Nanorods: Towards Improved Electronic Devices
103	No pentacene: 0.014 Pentacene(Vacuum):1 Pentacene(Air): 10	~5×10^2 ~3×10^2 1×10^3	25 36 5.9	Thermally evaporated BGTC; Au/silk fibroin/(pentacene)/C_{60}; Au Vacuum or Air	Solution-based silk fibroin dielectric in n-type C_{60} organic field-effect transistors: Mobility enhancement by the pentacene interlayer
	2014				
104	Height: ~1			HWE BGTC; Al/Parylene; Al(encapsulated) Air	Air stability of C_{60} based n-type OFETs
105	0.32	6×10^3	2.2	drop-casting/DCB BGTC; Si/SiO_2/BCB; Al Nitrogen	Comparative Study of the N-Type Doping Efficiency in Solution-processed Fullerenes and Fullerene Derivatives
106	BG: 0.1 TG: 0.2 dual gate: 0.9	~1×10^3 ~2×10^3 ~1×10^4	20.7~34.6 14.3~0.1 11.5~8.5	HWE under vacuum TG, BG or dual gate; Al/Parylene; Al Nitrogen	Geometrical Structure and Interface Dependence of Bias Stress Induced Threshold Voltage Shift in C_{60}-Based OFETs
107	10^{-4}Pa: 0.199±0.020 10^{-3}Pa: 0.204±0.015 10^{-2}Pa: 0.195±0.017 10^{-1}Pa: 0.090±0.013	10^5~10^7 10^5~10^7 10^5~10^7 10^5~10^7	11.9±0.8 7.2±1.0 8.7±0.7 13.2±1.2	Deposition under different pressure BGTC; Si /SiO_2/C_{60}, Au Vacuum	Influence of Deposition Pressure on the Film Morphologies, Structures, and Mobilities for Different-Shaped Organic Semiconductors
108	No DIP: 0.21±0.10 DIP: 2.62±0.32(Max:2.92)	3×10^4 4×10^5	17 5	Deposition under different pressure BGTC; Si/SiO_2/(DIP)/C_{60}, Cu Vacuum	Interface optimization using diindenoperylene for C_{60} thin film transistors with high electron mobility and stability
109	~1.6(lin)			HWE BGTC; ITO/BCB/C_{60}; LiF/Al Vacuum	Origin of Electric Field Dependence of the Charge Mobility and Spatial Energy Correlations in C_{60}-Based Field Effect Transistors
110	needle crystals: 0.08±0.04 (highest): 0.34±0.13 ribbon crystals: 2.0±0.61	>10^5 >10^6	15~43 36~85	Crystals grown from m-xylene(/CCl_4) BGTC; Si/SiO_2/BCB/C_{60}, Au Nitrogen	Solution-grown aligned C_{60} single-crystals for field-effect transistors
	2015				
111	Highest: 0.38	5.3×10^5	21.2	Vacuum deposition BGTC; Si/SiO_2/PVA/OTS/C_{60}/BCP, Al	A striking performance improvement of fullerene n-channel field-effect transistors via synergistic interfacial modifications
112	Average(Highest) m-xylene:0.07(0.155) CS_2:1.24(1.70) ODCB:0.3(1.06)	10^4~10^5	40~60	PAC method /m-xylene, CS_2, or ODCB BGTC; Si/SiO_2; Au Nitrogen	A Facile PDMS-Assisted Crystallization for the Crystal-Engineering of C_{60} Single-Crystal Organic Field-Effect Transistors
113	3.9×10^{-2} (dark) 6.7×10^{-3} (air)		45	Vacuum deposition BGTC; Si/SiO_2/OTS/C_{60}/PbPc, Au Air or dark box	Enhanced performance of isotype planar heterojunction photoresponsive organic field-effect transistors by using Ag source-drain electrodes

114	thermally anneal 50℃:0.002±0.001 90℃: 0.027±0.002 100℃: 0.055±0.004	~10^4 ~10^5 ~10^6	2.93 3.20 2.39	Spin-coating/ dichlorobenzene BGBC; Si/SiO_2/PTS/C_{60}; graphene Nitrogen	Solution-processed n-type fullerene field-effect transistors prepared using CVD-grown grapheme electrodes: improving performance with thermal annealing
115	①with PbPc:2.77×10^{-1}/6.64×10^{-1} ②with PbPc:2.41×10^{-5}/6.93×10^{-4} ①without PbPc: 2.48×10^{-2}/- ②without PbPc: 1.79×10^{-3}/-		6.80/6.77 28.7/14.3 14.1/- 29.5/-	Vacuum deposition ①BGTC; ITO/PVA/C_{60}/(PbPc), Au ②BGTC; Si/SiO_2/OTS/C_{60}/(PbPc), Au In the dark/under illumination	Ultrahigh near infrared photoresponsive organic field-effect transistors with lead phthalocyanine/C_{60} heterojunction on poly(vinyl alcohol) gate dielectric
	2016				
116	ODT: 0.15/0.88 (lin/sat↓) PFBT: 0.24/1.27 DABT: 0.3/1.52 No thiol derivatives: 0.12/0.56	6×10^4 7×10^4 9×10^4 2.5×10^5	10.1 8.5 6.3 10.5	Vacuum deposition BGBC; Al/SU8/C_{60}; thiol derivatives/Al Nitrogen	Improvement of n-type OTFT electrical stability by gold electrode modification
117	1.05	5.65×10^2	2.96	Vacuum deposition BGTC; Al/PVA/SDS/C_{60}/(encapsulation); Au Air	Poly(Vinyl Alcohol) Gate Dielectric Treated With Anionic Surfactant in C_{60} Fullerene-Based n-Channel Organic Field Effect Transistors
	2017				
118	5.6	>10^5	4.9	Drop/CCl_4 + *m*-xylene BGTC; Si /SiO_2/BCB/C_{60}; Au Nitrogen	Enhanced performance of field-effect transistors based on C_{60} single crystals with conjugated polyelectrolyte
119	Pure C_{60}: 2.43×10^{-2}(sat) Heterojunction:1.43×10^{-3}(sat)		37	Evaporation deposition BGTC; Si/SiO_2/C_{60}/(PTCDA:AlClPc:PbPc); Au in the dark or illumination	Towards high performance broad spectral response fullerene based photosensitive organic field effect transistors with tricomponent bulk heterojunctions

C_{70}

Ref.	Mobility ($cm^2\ V^{-1}\ s^{-1}$)	I_{on}/I_{off}	V_T (V)	Deposition Structure Measured in	Title
	1996				
120	2×10^{-3}	10^5	27	Vacuum deposition BGBC; Si/SiO_2; Au/Cr Vacuum	C_{70} thin film transistors
	2005				
22	0h: 0.060 1h in ambient: 0.042 24 h in nitrogen 0.041	3.9×10^5 1.5×10^5 1.2×10^5	34.7 40.1 42.2	Vacuum vapor deposition BGBC; Si/SiO_2; Ti/Au Nitrogen or Air	Fullerene based n-type organic thin-film transistors
	2013				
97	Cocrystals of C_{70}–DPTTA μ_e=0.05 μ_h=0.07			Drop-casting/chlorobenzene BGTC; Si/SiO_2; Au Vacuum	Fullerene/Sulfur-Bridged Annulene Cocrystals: Two-Dimensional Segregated Heterojunctions with Ambipolar Transport Properties and Photoresponsivity
	2014				
105	0.94	3×10^4	3.8	drop-casting/DCB BGTC; Si/SiO_2/BCB; Al Nitrogen	Comparative Study of the N-Type Doping Efficiency in Solution-processed Fullerenes and Fullerene Derivatives

PCBM

Ref.	Mobility ($cm^2\ V^{-1}\ s^{-1}$)	I_{on}/I_{off}	V_T (V)	Deposition Structure Measured in	Title
	2003				
121	Highest: 4.5×10^{-3}		41	Spin-coating/ chloroform BGTC; Au/Ti/resin; Ca or Al or Au Under ambient conditions (sealed)	Solution-Processed Organic n-Type Thin-Film Transistors
	2004				
122 123	μ_e=1×10^{-2} μ_h=8×10^{-3}	10^6 10^6		Spin-coating/ chlorobenzene BGBC; Si/SiO_2/HMDS/PCBM; Ti/Au Vacuum	①Ambipolar Organic Field-Effect Transistors Based on a Solution-Processed Methanofullerene; ②Organic complementary-like inverters employing methanofullerene-based ambipolar field-effect transistors
124	9×10^{-2}	10^4		Spin-coating/ chlorobenzene BGTC; ITO/PVA/PCBM; Cr Argon	Nonvolatile organic field-effect transistor memory element with a polymeric gate electret
125	μ_e=1×10^{-2} μ_h=8×10^{-3}	~10^6 ~10^6		Spin-coating/ chlorobenzene BGBC; Si/SiO_2/HMDS/PCBM; Ti/Au Vacuum	Organic complementary-like inverters employing methanofullerene-based ambipolar field-effect transistors

	2005				
126	0.02-0.1	~4×10^3	13.6	Spin-coating/ chlorobenzene BGTC or BGBC; Al-Nd/insulator; Ca, Mg, Al, Ag, Au; Air(with protector)	All-solution-processed n-type organic transistors using a spinning metal process
127	PVA: μ_e=5×10^{-4} BCB-Au: μ_e=5×10^{-5} BCB-Au: μ_h=1×10^{-5} BCB-LiF/Al: μ_e=10^{-4} PVP: poor transport properties	7 4		Spin-coating/ chlorobenzene BGTC; ITO/dielectric/PPV&PF&PCBM; LiF/Al or Au	Correlation between morphology and ambipolar transport in organic field-effect transistors
128	0.05-0.2	7.5×10^2~2×10^3	-20~7	Spin-coating/ chlorobenzene BGTC; ITO/BCB or PVA/PCBM; Cr or LiF/Al Argon	Fabrication and characterization of solution-processed methanofullerene-based organic field-effect transistors
129	0.024			Spin-coating/ chloroform BGTC; Si/SiO_2; Au	Relation between carrier mobility and cell performance in bulk heterojunction solar cells consisting of soluble polythiophene and fullerene derivatives
130	PCBM :10^{-3} PCBM&P3HT: 10^{-4}			Spin-coating/ chloroform BGTC; Si /SiO_2/insulator/PCBM(P3HT); Al Nitrogen	Study of field effect mobility in PCBM films and P3HT:PCBM blends
	2006				
131	μ_e=2.0×10^{-3} μ_h=1.7×10^{-3}			Spin-coating/ chlorobenzene BGBC; Si /SiO_2/PCBM&P3HT; Al Nitrogen	Ambipolar organic field-effect transistors fabricated using a composite of semiconducting polymer and soluble fullerene
132	μ_e=~10^{-6}~10^{-2} μ_h=~10^{-3}~10^{-4}			Spin-coating/ chloroform BGTC; Si/SiO_2/PCBM(&P3HT); Au Vacuum	Field effect measurements on charge carrier mobilities in various polymer-fullerene blend compositions
133	~10^{-4}-10^{-6}			Spin-coating/ chloroform BGBC; Si /SiO_2; Au Vacuum	Investigations of electron injection in a methanofullerene thin film transistor
134	PCBM-Au:0.008 PCBM-Mg:0.01 PCBM&P3HT:μ_e=7×10^{-5} PCBM&P3HT:μ_h=1×10^{-4}			Spin-coating/ chloroform BGTC; Si /SiO_2/PCBM(&P3HT); Au or Mg Vacuum	Investigations of the effects of tempering and composition dependence on charge carrier field effect mobilities in polymer and fullerene films and blends
135	Insulator PVA: 10^{-2} BCB: 10^{-2}			Spin-coating/ chlorobenzene BGTC; ITO/insulator/PCBM&PPV; LiF/Al Argon	Photoresponse of Organic Field-Effect Transistors Based on Conjugated Polymer/Fullerene Blends
	2007				
136	pure PCBM: 0.01	>10^4	20~38	Spin-coating/chloroform BGTC; Si/SiO_2/PCBM(&P3HT); Au Vacuum	Ambipolar Transport in Field-Effect Transistors Based on Composite Films of Poly(3-hexylthiophene) and Fullerene Derivative
137	1.1×10^{-5}			Spin-coating/chloroform BG BC or TC; Si/SiO_2; Au or Al Vacuum	Ambipolar Field-Effect Transistors Based on Poly(3-hexylthiophene)/Fullerene Derivative Bilayer Films
138	10^{-3}~10^{-4}(sat)	~10^4	~20(electron) ~5(hole)	Spin-coating/chlorobenzene BGBC; Si/SiO_2/HMDS/PCBM(&PPV); Ti/Au Vacuum or Nitrogen	Electro-optical circuits based on light-sensing ambipolar organic field-effect transistors
139	o-Xylene: 2×10^{-2} Chlorobenzene: 8×10^{-3}			Spin-coating/solvent BGBC; Si/SiO_2/HMDS; Au Nitrogen	Organic Field-Effect Devices as Tool to Characterize the Bipolar Transport in Polymer-Fullerene Blends: The Case of P3HT-PCBM
140	8.6×10^{-3}	1.5×10^5	43.0	Spin-coating/chloroform BGTC; Si/SiO_2/HMDS; Au Vacuum	Unipolarization of ambipolar organic field effect transistors toward high-impedance complementary metal-oxide-semiconductor circuits
141	0.02~0.034	4.5×10^5~1.42×10^6		Spin-coating/chloroform BGBC; Si/SiO_2/HMDS; Ti/Au; Nitrogen	Solution-Processed n-Type Organic Field-Effect Transistors With High ON/OFF Current Ratios Based on Fullerene Derivatives
	2008				
142	Vaccum: 0.025 Air: Not active	2×10^4	33	Spin-coating/ chloroform BGTC; Si/SiO_2/HMDS; Au Vacuum/Air	High-Performance n-Type Organic Thin-Film Transistors Based on Solution-Processable Perfluoroalkyl-Substituted C_{60} Derivatives
143	0.21	>10^4	7	Spin-coating/ chlorobenzene BGTC; ITO/BCB; Ca/Al Nitrogen	High mobility n-channel organic field-effect transistors based on soluble C_{60} and C_{70} fullerene derivatives
144	Au: 0.0081 Al: 0.0120 Ca/Al: 0.0227 Cs_2CO_3/Al: 0.0445	10^3 10^6 10^3 10^3	4.87 3.15 0.74 -2.30	Spin-coating/ chloroform BGTC; ITO/PVP; S/D Nitrogen	Improved performance in n-channel organic thin film transistors by nanoscale interface modification
145	Dark: 2.9×10^{-5} Light: 3.7×10^{-5}	~10^4	24 20	Spin-coating/ chloroform BGBC or BGTC; Si/SiO_2/HMDS; Au Vacuum	Light illumination effects in ambipolar FETs based on poly(3-hexylthiophene) and fullerene derivative composite films
146	μ_e=8.9×10^{-3}(lin) μ_h=5.7×10^{-3}(lin)			Spin-coating/CB(PCBM)&chloroform(P3HT) BGMC; Au/Ti/Si/SiO_2/PCBM/TiO_x/P3HT; Al Nitrogen	Multilayer bipolar field-effect transistors
	2009				
147	2.8×10^{-2}			Spin-coating/ chloroform BGTC; Si/SiO_2/PCBM/TiO_x; Al Nitrogen	Enhanced Performance of Fullerene n-Channel Field-Effect Transistors with Titanium Sub-Oxide Injection Layer

148	0.028			Spin-coating/chloroform BGTC; Si/SiO_2/OTS; Ca/Al Nitrogen	Heteroanalogues of PCBM: N-Bridged Imino-PCBMs for Organic Field-Effect Transistors
149	0.10-0.14	1×10^4~2×10^5	0.27~0.38	Spin-coating/ chlorobenzene BGTC;Ti/Au/Si/SiO_2/HfO_2/BCB;Ca Nitrogen or air	Low-voltage solution-processed n-channel organic field-effect transistors with high-k HfO_2 gate dielectrics grown by atomic layer deposition
150	0.03		0.1	Spin-coating/ chlorobenzene BGTC; Al/AlO_x/PHDA; Al vacuum	Solution processed low-voltage organic transistors and complementary inverters
151	10^{-5}(lin)		0-10	Spin-coating/ chlorobenzene BGTC; Al/BCB; Al	Studies of charge transfer processes across donor-acceptor interface using a field effect transistor geometry
152	Ca: N_2:0.12 ; Air:No Au: N_2:0.08 ; Air:0.04 Ca/Au: N_2:0.12 ; Air:0.06	N_2:5×10^5;Air: No N_2:2×10^5;Air: 1×10^5 N_2:1×10^6;Air: 3×10^5	N_2:2.1;Air: No N_2:4.6;Air: 6.7 N_2:2.1;Air: 5.4	Spin-coating/ chlorobenzene BGTC;Ti/Au/Si/SiO_2/BCB;Ca or Au or Ca/Au Nitrogen or air	Study of electrical performance and stability of solution-processed n-channel organic field-effect transistors
153	$\mu_e=5.8\times10^{-2}$(140°C anneal) $\mu_h=7.2\times10^{-2}$(140°C anneal)			Spin-coating BGTC; Si/SiO_2/PCBM&PTmT; Ag	Thermal annealing induced bicontinuous networks in bulk heterojunction solar cells and bipolar field-effect transistors
	2010				
154	PCBM/HMDS-Au: 6.0×10^{-6} PCBM/HMDS-LiF: 1.5×10^{-3} PCBM/OTS-Au: 1.0×10^{-4} PCBM/OTS-LiF: 8.6×10^{-2} PCBM/ODTS-LiF: 4.6×10^{-2} PCBM/P3HT: $\mu_e=1.5\times10^{-3}$ PCBM/P3HT: $\mu_h=3.3\times10^{-5}$	2.3 1.3×10^2 1.6 1.6×10^5 1.5×10^5	- 35 -9 40 38 29 45~74	Spin-coating/chloroform BGMC; Si/SiO_2/SAM/PCBM/(P3HT); LiF/Au Vacuum	Ambipolar Transport in Bilayer Organic Field-Effect Transistor Based on Poly(3-hexylthiophene) and Fullerene Derivatives
155	0.13	6×10^4	25	Spin-coating/chloroform BGTC; Si/SiO_2/OTS; Au Nitrogen	High-Performance Solution-Processed n-Channel Organic Thin-Film Transistors Based on a Long Chain Alkyl-Substituted C_{60} Derivative
156	0.125	4.67×10^6	19.10	Spin-coating/chlorobenzene BGTC; Si/SiO_2/BCB; Au Nitrogen	Use of a 1H-Benzoimidazole Derivative as an n-Type Dopant and To Enable Air-Stable Solution-Processed n-Channel Organic Thin-Film Transistors
	2011				
157	0.09		9.0	Spin-coating/ chlorobenzene BGTC; Si/SiO_2/BCB; Au or Al Nitrogen, Vacuum or Air	Soluble fullerene derivatives: The effect of electronic structure on transistor performance and air stability
	2012				
158	~0.01(pure PCBM)			Spin-coating/ o-dichlorobenzene BGBC; Si/SiO_2/HMDS/PCBM&polymer; Au Nitrogen	Ambipolar charge transport in polymer:fullerene bulk heterojunctions for different polymer side-chains
159	0.024~0.054	8.0×10^5~2.2×10^6	2.18~2.9	Spin-coating/ chloroform BGTC; Si/SiO_2/OTS/PCBM; Al Nitrogen	Effects of direct solvent exposure on the nanoscale morphologies and electrical characteristics of PCBM-based transistors and photovoltaics
160	Ca/Al: 0.104 Au: 0.051	3.5×10^6 4.6×10^6	8 12	Spin-coating / chloroform or DCB BGTC; Si/SiO_2/BCB; Ca/Al or Au Nitrogen	Evaluation of structure–property relationships of solution-processible fullerene acceptors and their n-channel field-effect transistor performance
161	Highest: 0.044	4.1×10^4	-2.61	Spin-coating / chloroform BGTC; ITO/PVP/PCBM/PEG; Al Nitrogen	Simple source/drain contact structure for solution-processed n -channel fullerene thin-film transistors
162	3×10^{-3}	10^3	20	Spin-coating/ chlorobenzene BGTC; Si /SiO_2/HMDS/PCBM&PB-PyDI; Al Vacuum	Synthesis and Characterization of a Pyromellitic Diimide-Based Polymer with C- and N-Main Chain Links: Matrix for Solution-Processable n-Channel Field-Effect Transistors
	2013				
163	2×10^{-8}~3×10^{-8}			Spin-coating BG; Si /SiO_2/HMDS/PCBM; Au Nitrogen	Microstructure and Optoelectronic Properties of P3HT-b-P4VP/PCBM Blends: Impact of PCBM on the Copolymer Self-Assembly
164	~0.04			Spin-coating/ chloroform BGTC; Si/SiO_2/HMDS/PCBM; Al	Organic [6,6]-phenyl-C_{61}-butyric-acid-methyl-ester field effect transistors: Analysis of the contact properties by combined photoemission spectroscopy and electrical measurements
165	8.70×10^{-2} (FP doped)2.2×10^{-2}	6.7×10^6	21	Spin-coating/ chloroform BGTC; Si /SiO_2/BCB/PCBM; Ag Nitrogen	Solution - Processible Highly Conducting Fullerenes
	2014				
105	0.057	2×10^3	15.7	Spin-coating/CB BGTC; Si/SiO_2/BCB; Al Nitrogen	Comparative Study of the N-Type Doping Efficiency in Solution-processed Fullerenes and Fullerene Derivatives
166	Highest: 0.12	~10^3	10.5	Spin-coating/ chlorobenzene TGBC; Al/CYTOP/PCBM/Interlayer; Au Nitrogen	Simultaneous Enhancement of Electron Injection and Air Stability in N-Type Organic Field-Effect Transistors by Water-Soluble Polyfluorene Interlayers
	2015				

167	No DAE: 1×10^{-2}~4.41×10^{-2} &DAE: 0.61×10^{-2}~3.80×10^{-2}	1.8×10^{7} 3.5×10^{5}~4.2×10^{5}		Spin-coating/ chlorobenzene BGBC; Si/SiO_2/HMDS/PCBM(&DAE); Au Nitrogen	Optically switchable transistors comprising a hybrid photochromic molecule/n-type organic active layer
	2016				
168	0.04		11	Spin-coating/DCB BGBC; Si/SiO_2; Au Air	Synthesis of Fullerene Derivatives for the Application to Organic Photovoltaic Cell and n-Channel Organic Thin-Film Transistors
169	BCB: 9.3×10^{-2} b-PS(8K): 7.3×10^{-2} b-PS(108K): 1.0×10^{-1}	$>10^{5}$ $>10^{5}$ $>10^{5}$	5.1 8.5 6.6	Spin-coating/ chlorobenzene BGTC; Si /SiO_2/BCB or b-PS/PCBM; Au Nitrogen	Use of a cross-linkable or monolayer-forming polymeric buffer layer on PCBM-based n-channel organic field-effect transistors
	2017				
170	Pure: 0.027 With P3HT: 0.01			Spin-coating/ toluene BGTC; Si/SiO_2/HMDS/PCBM&P3HT; Au Nitrogen	Balanced Ambipolar Organic Field-Effect Transistors by Polymer Preaggregation
171	8×10^{-3}			Spin-coating/ chlorobenzene TGBC; tungsten/water/CYTOP; Au Nitrogen	Water-Gated n-Type Organic Field-Effect Transistors for Complementary Integrated Circuits Operating in an Aqueous Environment

$PC_{71}BM$

Ref.	Mobility ($cm^2\ V^{-1}\ s^{-1}$)	I_{on}/I_{off}	V_T (V)	Deposition Structure Measured in	Title
	2005				
172	$\mu_e=1\times10^{-3}$ $\mu_h=2\times10^{-5}$	~10^{4} ~10^{4}		Drop cast/ chlorobenzene BGBC; Si/SiO_2/HMDS; /Au Vacuum	Solution processible organic transistors and circuits based on a C_{70} methanofullerene
	2008				
143	0.1			Spin-coating/ chlorobenzene BGTC; ITO/BCB; Ca/Al Nitrogen	High mobility n-channel organic field-effect transistors based on soluble C_{60} and C_{70} fullerene derivatives
	2009				
147	2.2×10^{-2}			Spin-coating/ chloroform BGTC; Si /SiO_2/$PC_{71}BM$/TiO_x; Al Nitrogen	Enhanced Performance of Fullerene n-Channel Field-Effect Transistors with Titanium Sub-Oxide Injection Layer
	2012				
160	Ca/Al: 0.066 Au: 0.018	2.6×10^{6} 1.1×10^{6}	8 22	Spin-coating / chloroform or DCB BGTC; Si/SiO_2/BCB; Ca/Al or Au Nitrogen	Evaluation of structure–property relationships of solution-processible fullerene acceptors and their n-channel field-effect transistor performance
	2013				
173	Pure $PC_{71}BM$: 0.016			Spin-coating/CB BGTC; Si/SiO_2/HMDS/$PC_{71}BM$&donor; Al Nitrogen	Electron and hole mobility in solution-processed small molecule-fullerene blend: Dependence on the fullerene content
	2014				
105	0.046	1×10^{3}	19.9	Spin-coating/CB BGTC; Si/SiO_2/BCB; Al Nitrogen	Comparative Study of the N-Type Doping Efficiency in Solution-processed Fullerenes and Fullerene Derivatives
	2016				
174	$\mu_e=1.3\times10^{-3}$ $\mu_h=2.7\times10^{-3}$			Spin-coating TGBC; tungsten/electrolyte/$PC_{71}BM$&polymer; Au Air	An organic water-gated ambipolar transistor with a bulk heterojunction active layer for stable and tunable photodetection
175	HMDS 7°C: 3.47×10^{-3} HMDS 25°C: 2.5×10^{-3} HMDS60°C:4.27×10^{-3}	10^{4} 10^{3} 10^{6}	22.2 10.0 14.8	Drop cast/ chlorobenzene BGBC; Si/SiO_2/HMDS; Au Nitrogen	$PC_{70}BM$ n-type thin film transistors: Influence of HMDS deposition temperature on the devices properties

2. LUMO converting

The LUMO of $IC_{70}MA$ and $IC_{70}BA$ comes from Yongfang Li group report [176] (CV was measured in a 0.1 mol/L tetrabutylammonium hexafluorophosphate (Bu_4NPF_6) in o-dichlorobenzene/acetonitrile (5:1) solution). The original data are $LUMO_1(IC_{70}MA)$=-3.85 eV, $LUMO_1(IC_{70}BA)$=-3.72 eV , $LUMO_1(PC_{60}BM)$=-3.91 eV . In Hojeong Yu et al. report [177] (CV was measured in a 0.1 mol/L tetrabutylammonium tetrafluoroborate (NBu_4BF_4) in o-dichlorobenzene solution), $LUMO_2(PC_{60}BM)$=-3.85 eV. In order to compare, we choose $PC_{60}BM$ as standard to calculate as follow:

$$LUMO(IC_{70}MA) = -3.85eV \times \frac{-3.85}{-3.91} = -3.79eV$$

$$LUMO(IC_{70}BA) = -3.72eV \times \frac{-3.85}{-3.91} = -3.66eV$$

3. Converting unit of solubility

Solubility of C_{60}, PCBM and C_{70}, $PC_{71}BM$ in various solvents

Solvent	Solubility		Ref.	Solubility		Ref.
	C_{60}			PCBM		
	mg/ml	10^{-3}mmol/ml		mg/ml	10^{-3}mmol/ml	
chloroform	0.16(r.t.)	0.22	178	28.8(25°C)	31.6	179
chlorobenzene	5.7(r.t.)	7.9	180	59.5(25°C)	65.4	
o-dichlorobenzene	24.6(r.t.)	34.2		42.1(25°C)	58.4	
	C_{70}			$PC_{71}BM$		
o-dichlorobenzene	36.2(303K)	43.1	181	225.2(25°C)	218.6	182

The date in the left is original data that come from the corresponding references, in order to give an intuitive comprehension and compare, the unit is converted from mg/ml to 10^{-3}mmol/ml. The more solubility can be see references: [183-185].

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