Supplementary Information

Electroluminescent materials towards near ultraviolet

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Table 1. Summary of physical properties for NUV emitters

Material	$\lambda_{Abs.}$ (nm) [a]	λ_{PL}[b] (nm)	PLQY[c] (%)	S_1 (eV)	T_1 (eV)	ΔE_{ST}[d] (eV)	T_g/ T_m/T_d[e] (℃)	HOMO [f] (eV)	LUMO (eV)
1	334	374, 392	66	3.16	–	–	174/352/382	−6.24	−2.85
2	334	374, 392	63	3.16	–	–	153/−/385	−6.22	−2.83
3	334	374, 392	57	3.16	–	–	169/−/424	−6.26	−2.87
4	310/333	374/392	56	–	–	2.3	228/−/464	−6.12	−2.43
5	299/309/323	399	–	–	–	–	99/240/−	−6.1	−2.6
6	299/310/324	381	–	–	–	–	103/174/−	−6.1	−2.7
7	298/309/322	369	–	–	–	–	183/256/−	−6.1	−2.55
8	299/309/323	392	–	–	–	–	237/498/−	−6.1	−2.6
9	399/378/360/341	432	89.5	–	–	–	−/298/257	−5.81	−2.63
10	403	443	14	–	–	–	−/408/429	−5.95	−3.02
11	357/376/397	424/436	74	–	–	–	−/409/550	−5.81	−2.79
12	254/368	410	37	–	–	–	148/312/442	−5.65	−2.55
13	368	400	56	–	–	–	82/−/−	–	–
14	~270/310	395	47	–	–	–	220/−/351	−5.20	−2.00
16	–	390	–	–	–	–	–	−6.30	–
17	–	~405	–	–	–	–	87/−/−	−5.50	−2.30
18	341	381	49	–	–	–	–	−5.20	−1.19
19	349	389	69	–	–	–	–	–	–
20	253/294	363	86	–	–	–	–	–	–
21	300	361/380	47.1	–	–	–	–	−6.01	–
22	241, 305, 329, 390	393	60	3.15	–	0.44	−/−/−	−5.98	−2.59

23	–	–	–	–	–	–	–	−6.6	−2.6
25	258/315/356	452	71.6	2.74	–	–	180/−/480	−5.54	−2.60
27	389	418	42	–	–	–	−/365/403	−6.13	−3.02
28	371/384	413/434	86	–	–	–	−/260/457	−5.92	−2.88
29	404	447	23	–	–	–	−/376/446	−6.01	−3.03
30	360	408	35	3.44	–	0.76	120/−/467	−5.23	−2.09
31	260/347	414	65	3.00	–	–	132/−/405	−5.5	−2.33
32	297/310	373/402/424	–	–	–	–	179/−/502	−5.63	−2.43
33	318	410[a]/432[b]	–	2.46	–	–	172/−/488	−5.55	−2.17
34	258/300/336	414/433	49.6	2.86	–	–	174/390/480	−5.30	−2.10
35	260/283/341	427/438	73	–	–	–	−/−/514	−5.23	−2.08
36	260/292/341/360	430	53	3.23	2.47	0.76	−/343/404	−5.53	−2.23
37	260/309/341	413	65.9	3.00	2.48	0.52	−/−/450	−5.71	−2.43
38	227/259/320	446	59.9	3.37	2.66	0.71	157/−/461	−5.48	−2.45
39	334	432	81.9	3.24	2.66	0.58	194/−/474	−5.74	−2.56
40	227/260/324	434	79.5	3.36	2.66	0.70	−/−/446	−5.68	−2.48
41	233/260/327	429	81.1	3.21	2.66	0.55	−/−/475	−5.70	−2.50
42	233/260/315	446	91.6	3.10	2.67	0.43	−/−/507	−5.71	−2.54
43	268/366	407	59	3.05	–	–	207/−/515	−5.35	−2.22
44	320	432	–	–	–	–	–	−5.90	−2.86
45	330	393	>95	–	–	–	–	–	–
46	336	390	21	–	–	–	62/160,169/380	−5.22	−0.93
47	349	408	23	–	–	–	−/241/368	−5.31	−2.01
48	352	417	27	–	–	–	59/187/397	−5.33	−2.11
49	344	411	27	–	–	–	73/173/399	−5.27	−1.98
50	340	400	24	–	–	–	69/180/374	−5.28	−2.00
51	362	419	35	–	–	–	126/241/332	−5.49	−2.36
52	–	408	–	–	–	–	–	–	–
53	337/355/382	452	–	–	–	–	–	−5.87	−2.68
54	264/324	393/414	28	–	–	–	−/−/406	−5.82	−2.53
55	259/288/340	397/416	42	–	–	–	−/−/627	−5.73	−2.48
56	257/306/346	426	68	–	–	–	−/−/640	−5.46	−2.25
57	262/296/368	466	80	–	–	–	−/−/632	−5.37	−2.35
58	243/279/310/348	428	72	–	–	–	−/−/655	−5.62	−2.44

59	303/354	392	41	–	–	–	−/−/514	−5.53	−2.27
60	293/371	401	100	–	–	–	−/−/280	−5.21	−1.40
61	336	435	19	–	–	–	117/286/>400	−5.32	−2.58
62	336	407	46	–	–	–	117/256/>400	−5.25	−2.52
63	336, 262, 225	407	90	3.38	2.63	0.75	−/119/416	−5.91	−2.44
64	345, 222	414	98	3.26	2.63	0.63	123/−/ 492	−5.91	−2.62
65	343, 305, 233	413	100	3.16	2.63	0.53	146/−/ 509	−5.75	−2.56
66	343, 264, 221	422	40	3.22	2.63	0.59	−/239/393	−5.90	−2.63
67	308/360/381/402	430	96	–	1.81	–	145/−/452	−5.66	−2.72
68	–	–	4 *fac-* 0.5 *mer-*		3.20 *fac-* 3.10 *mer-*	–	–	−5.10 *fac-* −4.80 *mer-*	−1.80 *fac-* −1.40 *mer-*
69	365/380	418 *fac-* 465 *mer*	95 91	–	–	–	–	−5.30 *fac-* −5.20 *mer-*	−1.50 *fac-* −1.00 *mer-*
70	214/228/272/290/311	412/427/454	72	–	3.08	–	–	−5.27	−1.92
71	326/338	411	87	3.45	3.35	0.10	207/−/246	−5.76	−2.56
72	293/346	428	98	–	–	0.62	157/−/498	−5.61	−2.45
73	304/347	416	79	–	–	0.65	143/−/486	−5.62	−2.46
74	309/329	394	92	~3.22	2.85	~0.37	211/−/438	−5.88	−2.48
75	–	423	80	3.30	2.98	0.32	–	−5.81	−2.52
76	346	391/384/392	69	3.46	2.97	0.49	215/341/427	−5.67	−2.27
77	331/355	403	28	3.34	3.02	0.32	−/−/368	−5.8	−2.52
78	338/367	414	76	3.23	2.97	0.26	−/−/397	−5.72	−2.49
79	~290/330	401	72	–	–	>0.8	–	−5.55	−2.29
80	336/368	433	96.8	2.86	–	–	192/−/510	−5.54	−2.40
81	300/370	429	68	–	–	–	125/−/355	−5.07	−2.08
82	341	428	75	–	–	–	−/−/480	−5.28	−2.12
83	358	454	49	2.42	3.01	0.59	103/−/422	−5.24	−2.25

[a] In chloroform solution (10^{-6} mol L^{-1}); [b] in film; [c] Measured with integral sphere; [d] singlet-triplet splitting; [e] temperature at weight loss of 5%; [f] calculated according to cyclic voltammetric results.

Table 2. EL performance of representative near-UV emitters.

Device structure	$V^{[a]}$	L_{max}[b] (cd m^{-2})	η[c] η_{CE} (cd A^{-1})	η_{PE} (lm W^{-1})	η_{EQE} (%)	CIE (x, y) λ_{EL} (nm)	Ref.
ITO | PEDOT:PSS (30 nm) | TCTA (40 nm) | **1** (30 nm) | TPBi (30 nm) | LiF (0.5 nm) | Al (150 nm)	2.5, 7.0, 8.5	4890	–, –, –	–, –, –	3.6, 3.6, –	– 392	1
ITO | PEDOT:PSS (30 nm) | TCTA (40 nm) | **2** (30 nm) | TPBi (30 nm) | LiF (0.5 nm) | Al (150 nm)	2.5, 7.0, 8.5	3183	–, –, –	–, –, –	2.8, 1.9, –	– 402	1
ITO | PEDOT:PSS (30 nm) |TCTA (40 nm) |**3** (30 nm) | TPBi (30 nm) | LiF (0.5 nm) | Al(150 nm)	2.5, 7.0, 8.5	2894	–, –, –	–, –, –	2.7, 1.9, –	– 396	1
ITO | PEDOT:PSS (30 nm) | TCTA (40 nm) | **4** (30 nm) | TPBi (30 nm) | LiF (0.5 nm) | Al	3.0, –, –	4020	–, –, –	–, –, –	2.6, –,–	– –	2
ITO | PEDOT:PSS | PVK | **5** | PBD | LiF | Al	–, –, –	–	–, –, –	–, –, –	2.9, –,–	– 385	3
ITO | PEDOT:PSS | PVK | **6** | PBD | LiF | Al	–, –, –	–	–, –, –	–, –, –	2.2, –,–	– 382	3
ITO | PEDOT:PSS | TCTA | **6** | TPBi | LiF | Al	–, –, –	–	–, –, –	–, –, –	2.0,–,–	–	4
ITO | PEDOT:PSS | PVK | **7** | PBD | LiF | Al	–, –, –	–	–, –, –	–, –, –	1.6, –, –	– 388	3
ITO | PEDOT:PSS | PVK | **8** | PBD | LiF | Al	–, –, –	–	–, –, –	–, –, –	2.1, –, –	– 395	3
ITO | HAT-CN (5 nm) |TAPC (40 nm) | mCP: **9** (20 nm) | Bphen (30 nm) | Liq (1 nm) | Al (150 nm)	3.5, –, –	–	–, –, –	–, –, –	6.0,5.1/,2.4	(0.15, 0.03) 412	5

ITO | TAPC (40 nm) | CBP: **10** (20 nm) | B3PyPB (40 nm) | LiF | Al	3.4, –, –	–	3.9, 1.8, 1.5	3.8, 1.2, 0.66	8.9, 4.3, 3.7	(0.16, 0.05) 424	[6]
ITO | PEDOT:PSS (40 nm) | TAPC (25 nm) | TCTA (5nm) | 5 wt% **11** in CBP (30 nm) | TmPyPB (40 nm) | LiF (0.5 nm) | Al (100 nm)	3.7, –, –	1909	–, –, –	–, –, –	2.4, –, –	(0.15,0 .04) 418	[7]
ITO | NPB (25 nm) | TCTA (5 nm) | **12** (30 nm) | TPBi (40 nm) | LiF (1.5 nm) | Al (100 nm)	4.0, –, –	1890	0.74, –, –	–, –, –	2.2, –, –	(0.16, 0.04) 396	[8]
ITO | *m*-MTDATA (50 nm) | **13** (20 nm) |F-TBB (10 nm) |Alq_3 (20 nm) |MgAg	4.0, –, –	1600	–, –, –	–, –, –	1.8, –,–	(0.16, 0.03)	[9]
ITO | CuPc (30 nm) |**14** (30 nm) | BCP (10 nm) | Alq_3 (30 nm) | LiF (0.5 nm) | Al (100 nm)	3.5, –, –	1040	–, –, –	–, –, –	1.2, –, –	– 401	[10]
ITO | MoO_3 (3 nm) | NPB (40 nm) | **15** (20 nm) | TPBi (20 nm) | Alq_3 (20 nm) | LiF (1 nm) | Al	–, –, –	–	–, –, –	–, –, –	3.3, –, –	– 408	[11]
ITO | CuPc (15 nm) | **16** | Bu-PBD (18 nm) | CsF (1 nm) | Al (200 nm)	–, –, –	–	–, –, –	–, –, –	1.3, –, –	– 390	[12]
ITO | *m*-MTDATA (50 nm) | **17** (20 nm) | F-TBB (10 nm) | Alq_3 (20 nm) | MgAg	4.0, –, –	3960	–, –, –	–, –, –	1.4, –, –	– 404	[13]
ITO | PEDOT:PSS | **18** | TPBi | Ca | Al	5.3, –, –	138	–, –, –	–, –, –	–, –, –	(0.16, 0.05) 422	[14]
ITO | PEDOT:PSS | **19** | TPBi | Ca | Al	5.5, –, –	361	–, –, –	–, –, –	–, –, –	(0.19, 0.08) 425	[13, 14]

ITO | PDOT | **20** | Ba | Al	9, –, –	11	0.07,-,-	0.02, –, –	–, –, –	– 372	[15]
ITO | CBP | **21** | BCP | Liq | Al	–, –, –	550	–, –, –	–, –, –	–, –, –	– 380	[16]
ITO (50 nm) | NPB (75 nm) | TCTA (5 nm) | PCzAc (5 nm) | mCP (5 nm) | mCBP:TSPO1:**22** (25 nm : 50 wt%: or 3 wt%) | TSPO1 (5 nm) | TPBi (20 nm) | LiF (1.5 nm) | Al (200 nm)	3.5, –, –	200	–, –, –	–, –, –	3.3, –, –	(0.16, 0.02) 402	[17]
ITO | MoO_3 (3 nm) | CBP (20 nm) | **23** (15 nm) | Bphen (80 nm)| LiF (2.5 nm) | Al (200 nm)	–, –, –	–	–, –, –	–, –, –	2.1, –, –	– 380	[18]
ITO | PEDOT:PSS/MoO_x | CBP (20 nm) | **23** (25 nm) | BPhen (75 nm) | LiF (2 nm) | Al (100 nm)	–, –, –	–	–, –, –	–, –, –	4.6, –, –	– 377	[19]
ITO | PEDOT:PSS/MoOx | CBP (25 nm) | **23** (20 nm) | BPhen (75 nm) | LiF (2 nm) | Al (100 nm)	–, –, –	–	–, –, –	–, –, –	4.4, –, –	–	[20]
ITO | PEDOT:PSS/MoS_2 | CBP (25 nm) | **23** (30 nm) | BPhen (85 nm) | LiF (2.5 nm) | Al (120 nm)	–, –, –	–	–, –, –	–, –, –	4.1, –, –	–	[21]
ITO | *h*-VO_x (1.6 mg/mL) | CBP (30 nm) | **23** (20 nm) | BPhen (80 nm) | LiF (2 nm) | Al (100 nm)	–, –, –	–	–, –, –	–, –, –	2.9, –, –	–	[22]
ITO | PTOPT:PBD (30 nm) | **24** | CaAl	4, –, –	–	–, –, –	–, –, –	1.3, –, –	– 394	[26]
Glass | SAS | WO_3 (1 nm) | TCTA (20 nm) |CBP (30 nm) | **24** (20 nm) | TPBi (35 nm) | LiF (1 nm) | Al (100 nm)	–, –, –	–	–, –, –	–, –, –	4.1, –, –	– 376	[27]
ITO | NPB (55 nm) | TCTA (10 nm) | CBP:**25** (10 wt% 30 nm) |TmPyPB (40 nm) | LiF (0.8 nm) | Al (80 nm)	3.6, –, –	>2000	1.78, -, -	1.45, –, –	4.1, –, –	(0.154, 0.05) 432	[28]
ITO | PTOPT:PSS | NPB | **26** | TPBi | LiF | Al	4.5, –, –	–	–, –, –	–, –, –	–, –, –	–	

ITO | 2-TNATA (30 nm) | NPB (10 nm) | TCTA (10 nm)| **27** (30 nm) | Alq_3 (30 nm) | LiF (1 nm) |Al (200 nm)	8.8, –, –	–	0.41,-,-	0.16, –, –	1.3, –, –	370 (0.18, 0.07)	[24]
ITO | PEDOT:PSS (35 nm) | CBP: **28** (2 wt%, 20 nm) | TPBi (32 nm) | LiF (1 nm) | Al (100 nm)	–, –, –	1253	-, 2.2, 1.3	–, 1.6, 0.7	–, 5.8, 3.3	423 (0.16, 0.06)	[25]
ITO | TAPC (40 nm) | **29** (20 nm) | B3PyPB (40 nm) | LiF | Al	3.5, –, –	–	4.9, 2.7, 1.9	4.8, 1.6, 0.81	9.5, 5.2, 4.0	412 (0.15, 0.06)	[6]
ITO| MoO_3 (7 nm) | NPB (80 nm) |TCTA (5 nm) | **30** | TPBi (40 nm) | LiF (1 nm) | Al (100 nm)	3.2, –, –	4065	0.84, –, –	0.48, –, –	3.3 –, –	430 (0.16, 0.05)	[29]
ITO | NPB (80 nm) | **31** (30 nm) | TPBi (50 nm) | LiF (0.5 nm) | Al (100 nm)	–, –, –	3322	0.65, –, –	0.48, –, –	1.9, –, –	405 (0.17, 0.05)	[30]
ITO | NPB (80 nm) | **32** (30 nm) | TPBi (50 nm) | LiF (0.5 nm) | Al (100 nm)	–, –, –	4329	1.53, –, –	0.86, –, –	3.0, –, –	420 (0.17, 0.06)	[30]
ITO | PEDOT:PSS | TCTA (30 nm) | CBP: **33** (3 wt% 30 nm) | TPBi (40 nm) | CsF | Al	2.5-3, –, –	–	–, 1.04, –	-, 0.45, -	4.1, 2.9, –	428 (0.16, 0.05)	[31]
ITO | NPB (70 nm) | TCTA (5 nm) | **34** (30 nm) | TPBi (30 nm) | LiF (1 nm) | Al (150 nm)	2.7, –, –	2267	1.28, 1.25, –	1.12, 0.86, –	2.7, 2.7, –	410 (0.15, 0.05)	[32]
ITO | HAT-CN (15 nm) | TAPC (65 nm) | TCTA (5 nm) | **35** (20 nm) |	3.0, –, –	3366	2.60, 2.46, 1.92	2.72, 1.97,1.02	5.6, 5.3, 4.2	414 (0.15,	[33]

TPBi (40 nm) | Liq (1.25 nm) | Al (120 nm)						0.05) 429	
ITO|NPB (40 nm) | TCTA (8 nm) | **37** (25 nm) | TPBi (40 nm) | LiF (1 nm) | Al (150 nm)	3.5, –, 5.2	3835	1.8, –, 1.1	1.7, –, 0.7	4.3, –, 2.5	(0.16, 0.05) 425	[34]
ITO | TAPC (40 nm) | TCTA (5 nm) | **37** (30 nm)| TPBi (30 nm) | LiF (0.8 nm) | Al (100 nm)	2.75, –, –	8951	2.30, –, –	2.06, –, –	5.3, –, –	(0.15, 0.05) 424	[35]
ITO | NPB (70 nm) | TCTA (5 nm) | **38** (30 nm) | TPBi (30 nm) | LiF (1 nm) | Al (120 nm)	4.7, –, –	–	2.14, 1.00, –	1.68,0.41, –	3.6, 2.4, –	(0.16,0 .05) 426	[36]
ITO | NPB (70 nm) | TCTA (5 nm) | **39** (30 nm) | TPBi (30 nm) | LiF (1 nm) | Al (120 nm)	4.7, –, –	–	1.56, 1.47, –	1.00, 0.67, –	4.3, 4.0, –	(0.16,0 .05) 428	[36]
ITO | NPB (70 nm) | TCTA (5 nm) | **40** (30 nm) | TPBi (30 nm) | LiF (1 nm) | Al (120 nm)	3.7, –, –	–	1.50, 1.49, –	1.13, 0.56, –	4.6, 4.5, –	(0.16,0 .05) 421	[36]
ITO | NPB (70 nm) | TCTA (5 nm) | **41** (30 nm) | TPBi (30 nm) | LiF (1 nm) | Al (120 nm)	4.1, –, –	–	1.80, 1.65, –	0.38, 0.90, –	5.7, 5.1, –	(0.16,0 .05) 420	[36]
ITO | NPB (70 nm) | TCTA (5 nm) | **42** (30 nm) | TPBi (30 nm) | LiF (1 nm) | Al (120 nm)	3.9, –, –	–	3.22,2.67, –	2.71, 1.45, –	5.9, 5.7, –	(0.16,0 .06) 429	[36]
ITO | PEDOT:PSS (40 nm) | NPB (80 nm) | TCTA (10 nm) | **43** (30 nm) | TPBi (30 nm) | LiF (0.5 nm) |Al (100 nm)	5.8, –, –	627	0.35, –, –	–, –, –	0.6, 0.4, –	– 408	[37]
ITO | TAPC (40 nm) | mCP: **44** (4 wt% 20 nm) | OXD-7 (40 nm) | LiF	2.9±0.1,	–	–, –, –	–, –, –	3.1±0.3, –, –	(0.15,	[38]

(1 nm) | Al (50 nm)	–, –					0.06) 430	
ITO | TAPC (40 nm) | mCP: **45** (5 wt% 20 nm) | UGH2 (5 nm) | OXD-7 (40 nm) | LiF (1 nm) | Al (50 nm)	3.2，–, –	–, –, –	–, –, –	–, –, –	1.6, –, –	– 393	39
ITO | NPB (40 nm) | TCTA (20 nm) | **46** (40 nm) | TPBi (40nm) | LiF (1 nm) | Al (70 nm)	–, –, –	1355	0.43, –, –	–, –, –	–, –, –	(0.18, 0.12) 424	40
ITO | NPB (40 nm) | TCTA (20 nm) | **47** (40 nm) | TPBi (40nm) | LiF (1 nm) |Al (70 nm)	–, –, –	81	0.38, –, –	–, –, –	–, –, –	(0.17, 0.10) 408	40
ITO | NPB (40 nm) | TCTA (20 nm) | **48** (40 nm) | TPBi (40nm) | LiF (1 nm) | Al (70 nm)	–, –, –	.54	0.39, –, –	–, –, –	–, –, –	(0.16, 0.06) 428	40
ITO | NPB (40 nm) | TCTA (20 nm) | **49** (40 nm) | TPBi (40nm) | LiF (1 nm) | Al (70 nm)	–, –, –	1600	0.48, –, –	–, –, –	–, –, –	(0.16, 0.07) 416	40
ITO | NPB (40 nm) | TCTA (20 nm) | **50** (40 nm) | TPBi (40nm) | LiF (1 nm) | Al (70 nm)	–, –, –	975	0.48, –, –	–, –, –	–, –, –	(0.17, 0.08) 424	40
ITO | NPB (40 nm) | TCTA (20 nm) | **51** (40 nm) | TPBi (40nm) | LiF (1 nm) | Al (70 nm)	–, –, –	693	0.60, –, –	–, –, –	–, –, –	(0.17, 0.08) 416	40
ITO | 2T-NATA (25 nm) | NPB (25 nm) | TCTA (10 nm) | **52** (20 nm) | TPBi (30 nm) | LiF | Al	–, –, –	–	1.8, –, –	–, –, –	2.6, –, –	(0.17, 0.09) 408	41
ITO | PEDOT:PSS (35 nm) | CBP : **53** (1wt%) | TPBi (32 nm) | LiF	5.6, –, –	1168	0.8, –, –	0.5, –, –	3.1, –, –	(0.16,	42

(1 nm) | Al (100 nm)						0.04) 404	
ITO|PEDOT:PSS| 3 wt% **54** in CBP |TPBi|LiF|Al	5.7, –, –	876	0.5 –, –	0.3, –, –	2.8, –, –	(0.16, 0.05) 396	[43]
ITO|PEDOT:PSS| 3 wt% **55** in CBP |TPBi|LiF|Al	4.9, –, –	963	0.6 –, –	0.4, –, –	3.0, –, –	(0.16, 0.04) 400	[43]
ITO|PEDOT:PSS| 3 wt% **56** in CBP |TPBi|LiF|Al	5.9, –, –	870	0.8 –, –	0.4, –, –	2.6, –, –	(0.16, 0.05) 408	[43]
ITO|PEDOT:PSS| 1 wt% **58** in CBP |TPBi|LiF|Al	5.3, –, –	1307	1.1 –, –	0.7, –, –	3.1, –, –	(0.16, 0.05) 416	[43]
ITO | HATCN (5 nm) | NPB (40 nm) | mCP (10 nm) | 12 wt% **60** :PPF (20 nm) | PPF (10 nm) | TPBi (40 nm) | LiF (1 nm) | Al	4.6, –, –	352	0.99, –, –	0.68, –, –	2.15, –, –	(0.16, 0.06) 420	[44]
ITO | MoO_3 (5 nm) | NPB (50 nm) | TCTA (5 nm) | **61** (20 nm) | TPBi (30 nm) | LiF (1 nm) | Al	3.1, 6.5, 7.1	–	1.18, –, –	1.13, –, –	1.96, –, –	(0.15, 0.07) –	[45]
ITO | MoO_3 (5 nm) | NPB (50 nm) | TCTA (5 nm) | **62** (20 nm) | TPBi (30 nm) | LiF (1 nm) | Al	3.3, 6.5, 7.1	–	1.50, –, –	2.19, –, –	2.71, –, –	(0.16, 0.07) –	[45]
ITO | MoO_3 (8 nm) | NPB (70 nm) | TCTA (5 nm) | **63** (20 nm) | TPBi (30 nm) | LiF (1 nm) | Al	3.1, <6.9,<1 0.7	1976	0.75, 0.56, –	0.76, 0.26, –	1.10, 0.95, –	(0.16, 0.08) –	[46]

ITO | MoO_3 (8 nm) | NPB (70 nm) | TCTA (5 nm) | **64** (20 nm) | TPBi (30 nm) | LiF (1 nm) | Al	3.1, <6.1,<9.9	2444	1.00, 0.79, –	1.01, 0.41, –	1.70, 1.56, –	(0.16, 0.06) –	[46]
ITO | MoO_3 (8 nm) | NPB (70 nm) | TCTA (5 nm) | **65** (20 nm) | TPBi (30 nm) | LiF (1 nm) | Al	3.1, <6.3,<10.5	1253	1.92, 1.51, –	0.73, 0.25, –	1.45, 1.06, –	(0.15, 0.05) –	[46]
ITO | MoO_3 (8 nm) | NPB (70 nm) | TCTA (5 nm) | **66** (20 nm) | TPBi (30 nm) | LiF (1 nm) | Al	3.1, <5.3,<8.7	2389	1.03, 0.97, –	0.75, 0.05, –	1.48, 1.43, –	(0.15, 0.07) –	[46]
ITO | MoO_3 (10 nm) | *m*CP (20 nm) | **67** (50 nm) | LiF (1 nm) | Al (100 nm)	3.6, –, –	8328	2.72, 2.72, 2.37	2.25, 1.22, 0.68	3.0, 3.0, 2.7	(0.16,0.05) 430	[47]
ITO | NPD (30 nm) | TCTA (10 nm) | UGH2:**68** (10 wt%) (25 nm) | BCP (35 nm) | LiF (0.5 nm) | Al (50 nm)	–, –, –	–	–, –, –	1.7,-,-	2.6, –, –	(0.17, 0.08) 410	[48]
6ITO| CzSi:MoO_3 (15 wt%) (10 nm) | CzSi (5 nm) | **69** (5 nm) | TSPO1: *fac*-**Ir(pmp)$_3$** (Graded doping) (40 nm) |TSPO1 (5 nm) | TPBi (30 nm) | Alq_3 (1.5 nm)|Al (50 nm)	4, –, –	>7800	–, –, –	–, –, –	10.1	(0.16, 0.09) 427	[49]
ITO | TAPC (40 nm) | 1 (10 nm) | DPEPO: **70** (10 wt%) (20 nm) | TPBi (30 nm) | LiF (1 nm) | Al (100 nm)	4.05, –, –	–	–, –, –	3.50,2.98, –	13.4,12.5, –	(0.15, 0.05) 430	[50]
ITO | MoO_3 (2 nm) | TAPC (15 nm) | 2,6-DCzppy: **71** (6 wt% 5 nm) | TmPyPB (30 nm) | LiF | Al	–	5377	5.01,2.69,4.74	–, –, –	20.4, –,–	(0.16, 0.03) 412	[51]
ITO | NPB (30 nm) | mCP (10 nm) | **72** (30 nm) | TPBi (30 nm) | LiF (1.5 nm) | Al (100 nm)	–	–	–, –, –	1.58,1.10,0.57	4.2,4.2,3.2	(0.16, 0.05)	[52]

						426	
ITO | NPB (30 nm) | mCP (10 nm) | **73** (30 nm) | TPBi (30 nm) | LiF (1.5 nm) | Al (100 nm)	2.8, –,–	–	0.82,0.82,0.73	0.84,0.59,0.33	2.7,2.7,2.2	(0.16, 0.04) 417	[52]
ITO | PEDOT:PSS | **74** | TPBi | Cs_2CO_3 | Al	6.0, –,–	1100	0.32, –,–	-,-,-	0.2, –,–	- 402	[53]
ITO | α-NPD (30 nm) | TCTA (20 nm) | CzSi (10 nm) | DPEPO:**75** (10 wt%, 20 nm) | DPEPO (10 nm) | TPBI (30 nm) | LiF (1 nm) | Al	–, –, –	–	–, –, –	–, –, –	9.9, –,–	(0.15, 0.05) 420	[54]
ITO | HAT-CN (6 nm) | HAT-CN (0.2 wt%): TAPC (50 nm) | TCTA: 10 wt% **76** (10 nm) | CzSi: 10 wt% **70** (10 nm) |Tm3PyP26PyB (50 nm) | LiF (1 nm) | Al (100 nm)	4.1, –,–	1031	3.1, –,–	–, –, –	9.3,1.8,1.3	(0.18, 0.07) 389	[55]
ITO | TAPC (40 nm) | mCP (10 nm) | DPEPO: **77** (10 wt%, 20 nm) | DPEPO (10 nm) | TPBi (30 nm) | LiF (0.8 nm) | Al (100 nm)	4.5, –,–	–	0.8, –,–	0.6, –,–	2.5, 0.1,-	(0.15, 0.05) 418	[56]
ITO | TAPC (40 nm) | mCP (10 nm) | DPEPO: **78** (10 wt%, 20 nm) | DPEPO (10 nm) | TPBi (30 nm) | LiF (0.8 nm) | Al (100 nm)	4.0, –,–	–	5.1, –,–	3.5, –,–	10.3,5.4,-	(0.16, 0.06) 428	[56]
ITO | MoO_3 (8 nm) |NPB (80 nm) | TCTA (10 nm) | **79** (20 nm) | TPBi (40 nm) |LiF (1 nm) | Al (100 nm)	3.2, –,–	3113	2.85, –,–	-, -, -	6.6, 4.0, -	(0.17, 0.07) 408	[57]
ITO|HATCN(15 nm) |TAPC (55 nm) |TCTA (5 nm) | DPEPO: **80** (10 wt% 20 nm) | TmPyPb (40 nm) | LiF (1 nm) | Al (100 nm)	3.0, –,–	270	1.62, –,–	-, -, -	4.96, –,–	(0.16, 0.04) 425	[58]
ITO | NPB (70 nm) | TCTA (5 nm) | CBP: **81** (10 wt% 30 nm) | TPBi (30 nm) | LiF (1 nm) | Al (100 nm)	3.4, –,–	>2000	1.89 ± 0.05, –,–	1.51 ± 0.10, –,–	5.5 ± 0.2, –,–	(0.16, 0.04)	[59]

ITO | MoO_3 (6 nm) | NPB (30 nm) | **82** (20 nm) | TPBi (50 nm) | LiF (0.8 nm) | Al (100 nm)	4, –,–	7323	–, –, –	–, –, –	6.8, –,5.4	0.158, 0.043) 430	60
ITO | HATCN (5 nm) | TAPC (50 nm) | **83** (20 nm) | TPBi (55 nm) | LiF (1 nm) | Al (100 nm)	3.1, –,–	4970	2.41, –,–	2.20, –,–	5.9, –,–	0.16, 0.05) 417	61
ITO | TaOx (50 nm) | **ZnO QDs** (50 nm) | TaOx (50 nm) | Au (50 nm)	–, –, –	–	–, –, –	–, –, –	<1, –, –	–	62
p-GaN| HfO_2| **ZnO QDs**| Al-doped ZnO | Ag	–, –, –	–	–, –, –	–, –, –	–, –, –	–	63
ITO | PEDOT:PSS (20 nm) | poly-TPD (20 nm) | PVK (20 nm) | **ZnSe/ZnS QD** (40 nm) | ZnO (30 nm) | Al (100 nm)	–, –, –	–	–, –, –	–, –, –	0.65, –, –	–	64
ITO | ZnO | **QDs** | CBP | MoO_3 | Al	–, –, –	–	–, –, –	–, –, –	0.23, –, –		65
ITO | PEDOT:PSS (40 nm) |PVK (30 nm) | **ZnSe/ZnS core/shell QDs** (25 nm) | ZnO NPs (30 nm) | Al	–	2632	1.38, –, –	0.53, –, –	7.83, –, –	(0.17, 0.02)	66
ITO | Mg:ZnO | **$CH_3NH_3Pb(Br_{0.4}Cl_{0.6})_3$** | CBP | MoOx | Au	–, –, –	–	–, –, –	–, –, –	–, –, –	–	67
ITO | PEDOT:PSS (30 nm) | **$(PEA)_2PbBr_4$** | TPBi (35 nm) | Ca (25 nm) | Al (100 nm)	2.5, –, –	–	–, –, –	–, –, –	0.04, –, –	–	68

[a] At 1, 100 and 1000 cd m^{-2}; [b] the maximum luminance; [c] EL efficiencies at the maximum and 100 and 1000 cd m^{-2}.

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