

Supporting Information

**ZnMgO:PVP inorganic–organic hybrid electron transport layer:
Towards efficient bottom-emission and transparent quantum dot
light-emitting diodes**

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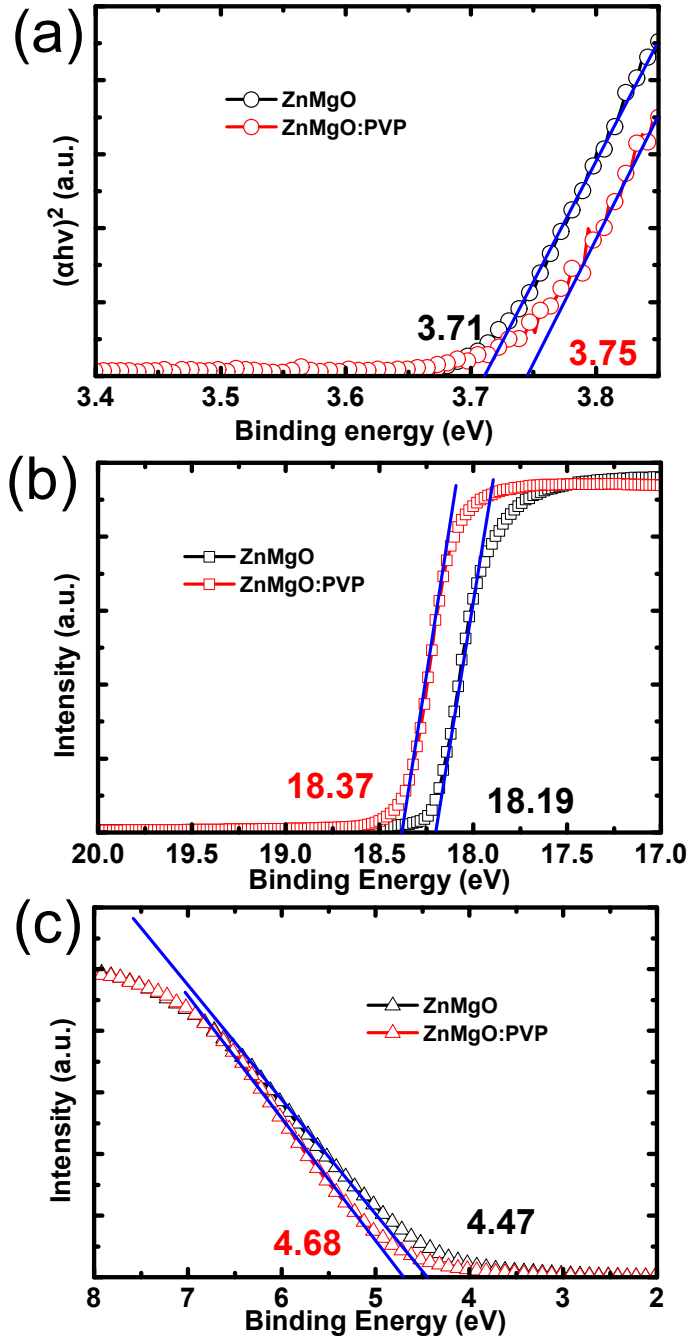


Figure S1. (a) $(\alpha h\nu)^2$ - $h\nu$ plots obtained by transformation of the absorption spectra of ZnMgO NPs and ZnMgO:PVP hybrid films. (b) secondary-electron cut-off and (c) valence band edge regions of ZnMgO NPs and ZnMgO:PVP hybrid films. According to the equation of VBM (valence band maximum) = $21.22 - (E_{\text{cut-off}} (\text{high-binding energy cut-off}) - E_{\text{onset}} (\text{onset energy in valence-band region}))$, the VBM of the ZnMgO and ZnMgO:PVP are estimated to be 7.50 eV and 7.53 eV, respectively. The band gap of ZnMgO and ZnMgO:PVP are about 3.71 eV and 3.75 eV, respectively, which were obtained from the UV-visible absorption spectra. Consequently, the

derived conduction band minimum (CBM) are 3.79 eV for ZnMgO and 3.78 eV for ZnMgO:PVP.

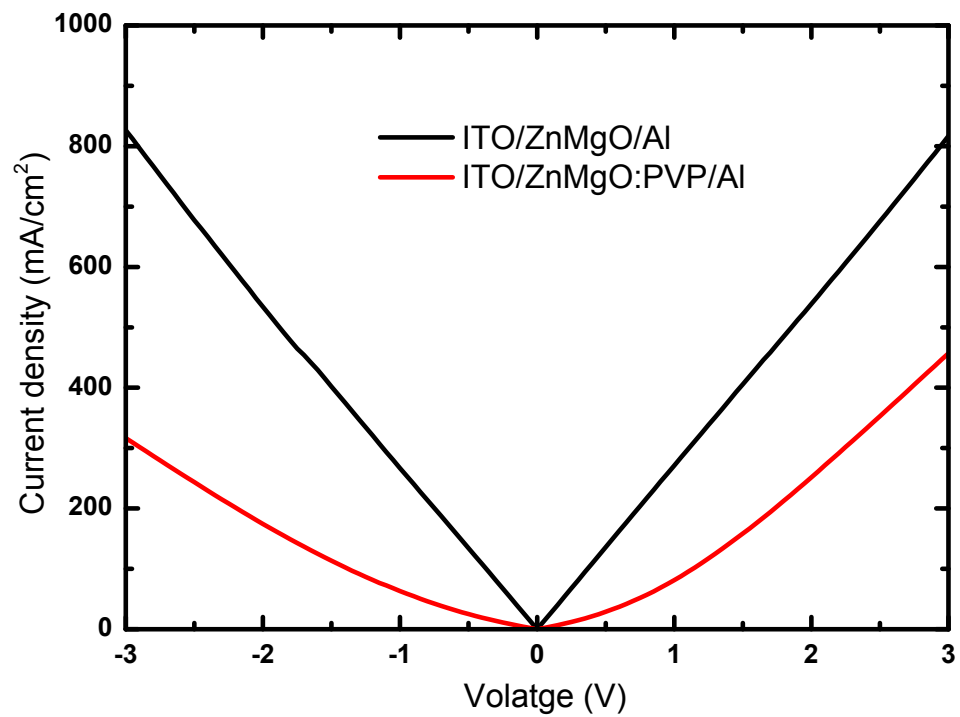


Figure S2. Comparison of J-V characteristics of the ETL-only devices with the structures of ITO/ZnMgO/Al and ITO/ZnMgO:PVP/Al.

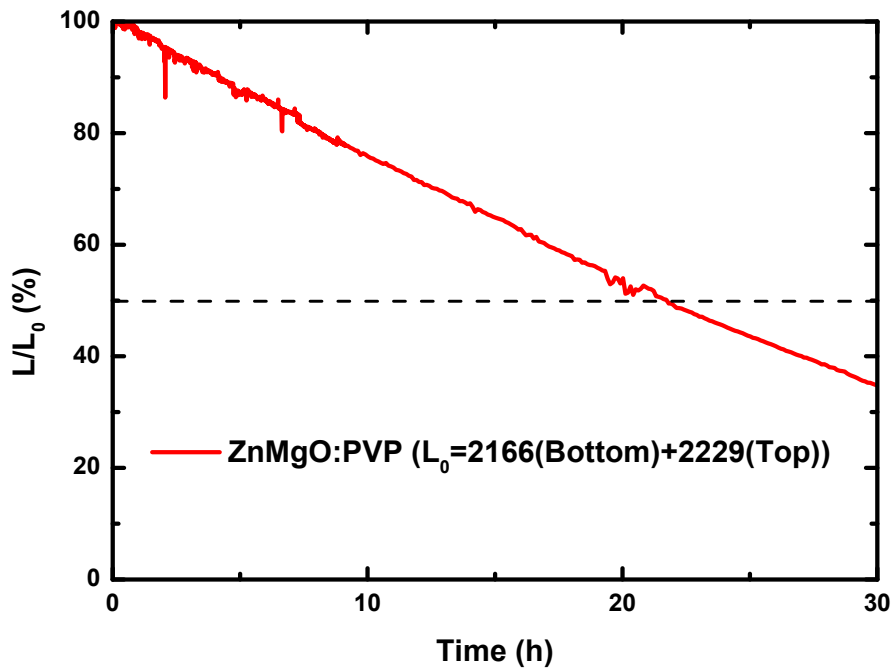


Figure S3. Lifetime curve of the transparent QLEDs with ZnMgO:PVP as ETL. By using the relation $L/L_0 = \text{constant}$ and assuming an acceleration factor of $n = 1.5$, the T_{50} of this transparent QLEDs at 100 cd/m^2 is estimated to be more than 6323 h.

Table S1. The key performances of the representative transparent QLEDs in literature.

Anode	Cathode	Max. Transparency	Von (V) (single side)	Max. CE (cd/A) (single side)	Max. L (cd/m ²)			Ref.
					Bottom	Top	Total	
ITO	Ag	~ 60%	2.95	1.25	10540 (@ 8.6 V)	2800 (@ 8.6 V)	13340 (@ 8.6 V)	1
Graphene	Graphene	~ 75 %	~ 20	0.45	358 (@ 29 V)	-	-	2
ITO	AgNW	~ 72 %	~2.5	5.6	<20000 (@ 6 V)	<20000 (@ 6 V)	<40000 (@ 6 V)	3
ITO	IZO	~ 84 %	~ 8	0.45	200 (@ 16 V)	-	-	4
ITO	ITO	~ 80 %	~ 2.5	3.5	9146 (@ 15 V)	<9146 (@ 15 V)	<18292 (@ 15 V)	5
ITO	ITO	~ 91	~ 3	17.52	<20000 (@ 6 V)	<20000 (@ 6 V)	<40000 (@ 6 V)	6
ITO	ITO	~ 88	2.1	22.75	20400 (@ 6 V)	22210 (@ 6 V)	42610 (@ 6 V)	ours

References

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