Electronic Supporting Information (ESI)

In-Situ Interfacial Passivation by Arylphosphine Oxide and Phosphonate Electron Transporting Layer for Efficient All-Solution-Processed PeQLEDs

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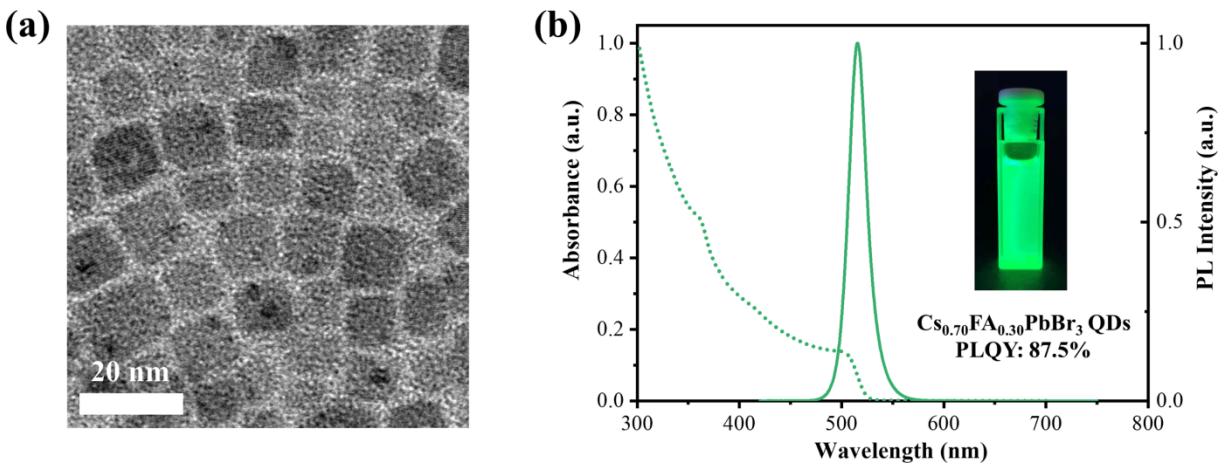

Fig. S1 TEM images of $Cs_{0.70}FA_{0.30}PbBr_3$ QDs (a). Absorption and PL spectra in toluene solution of $Cs_{0.70}FA_{0.30}PbBr_3$ QDs (dash line: absorption spectra; solid line: PL spectra). Inset: photograph of $Cs_{0.70}FA_{0.30}PbBr_3$ QDs solution in toluene under UV lamp with corresponding PLQY values listed on bottom (b).

Table S1. Physical parameters of used solvents.

Solvent	Chloro-benzene	O-dichloro-benzene	Methyl benzoate	Methyl acetate	Cyclohex-anone	Methanol	Ethanol	Isobutanol
b.p.[a] (^oC)	132.2	180.4	198	57.8	155	64.7	78	108
μ[b] (mPa·s)	0.8	1.33	1.94	0.38	2.2	0.6	1.2	4.7
ε[c] ($C^2/(N \cdot M^2)$)	5.6	9.9	6.6	6.7	18.6	32.6	24.3	15.8

[a]Boiling point. [b]Viscosity at 20-25 ^{o}C. [c]Dielectric constant.

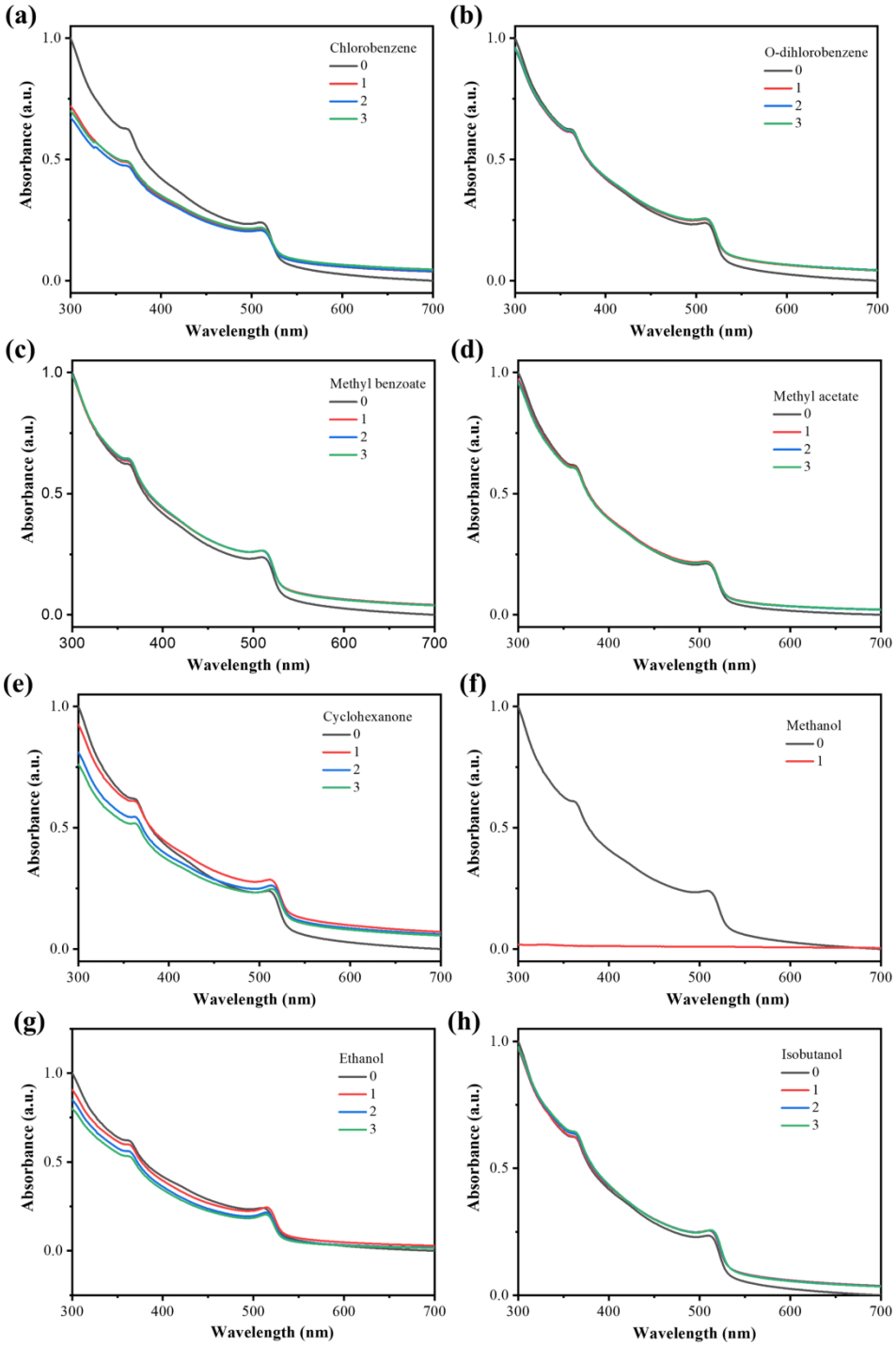

Fig. S2 UV-Vis absorption spectra for PeQDs film after different spin-rinsing time with chlorobezene (a), O-chlorobezene (b), methyl benzoate (c), methyl acetate (d), cyclohexanone (e), methanol (f), ethanol (g) and isobutanol (h).

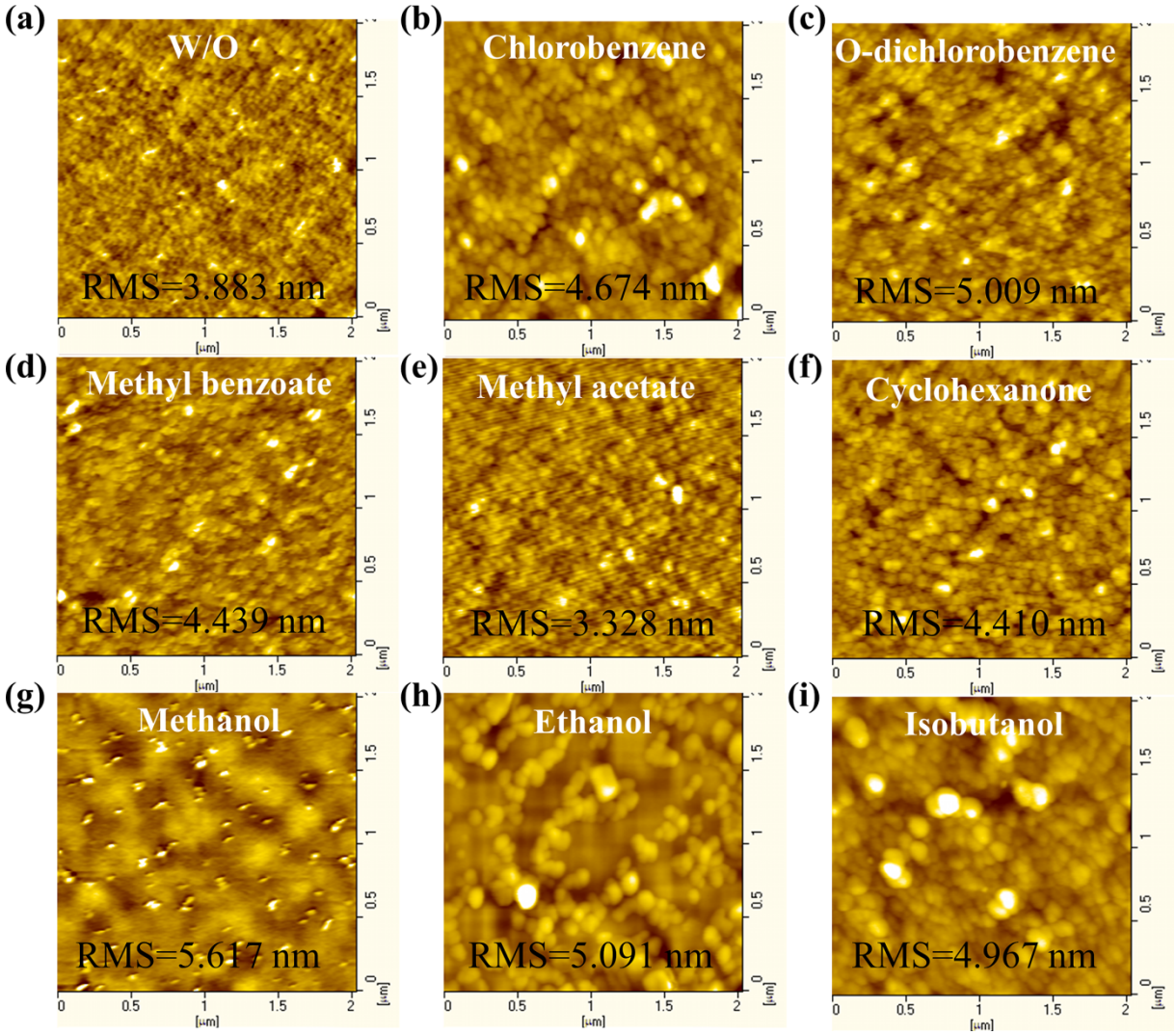

Fig. S3 AFM images of PeQDs films before spin-rinsing (a) and after spin-rinsing with chlorobezene (b), O-chlorobezene (c), methyl benzoate (d), methyl acetate (e), cyclohexanone (f), methanol (g), ethanol (h) and isobutanol (i).

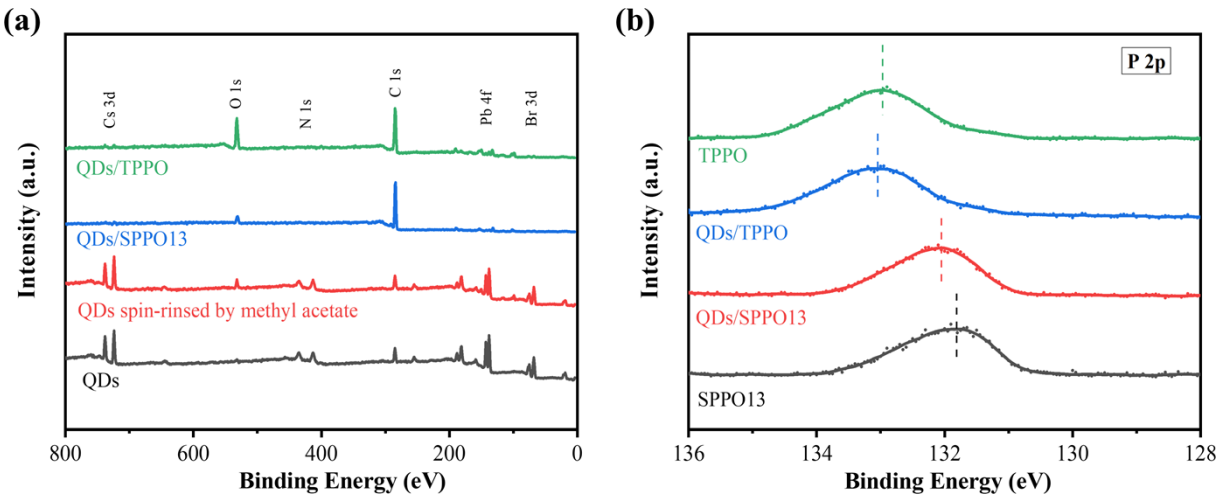

Fig. S4 XPS spectra. (a) Survey sprctra of pristine PeQDs films, QDs film spin-rinsed by methyl acetate, QDs/SPPO13 film and QDs/TPPO film. (b) P 2p spectra of QDs/SPPO13 film and QDs/TPPO film with SPPO13 and TPPO as references.

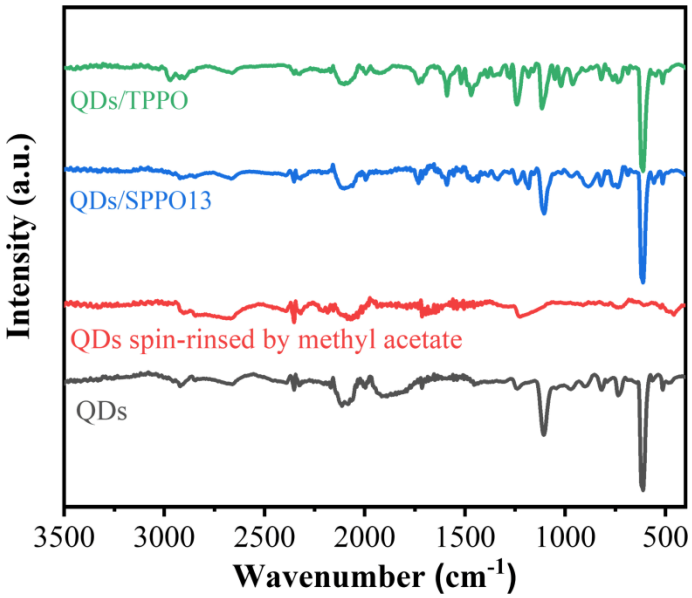

Fig. S5 FTIR spectra for pristine PeQDs films, QDs film spin-rinsed by methyl acetate, QDs/SPPO13 film and QDs/TPPO film.

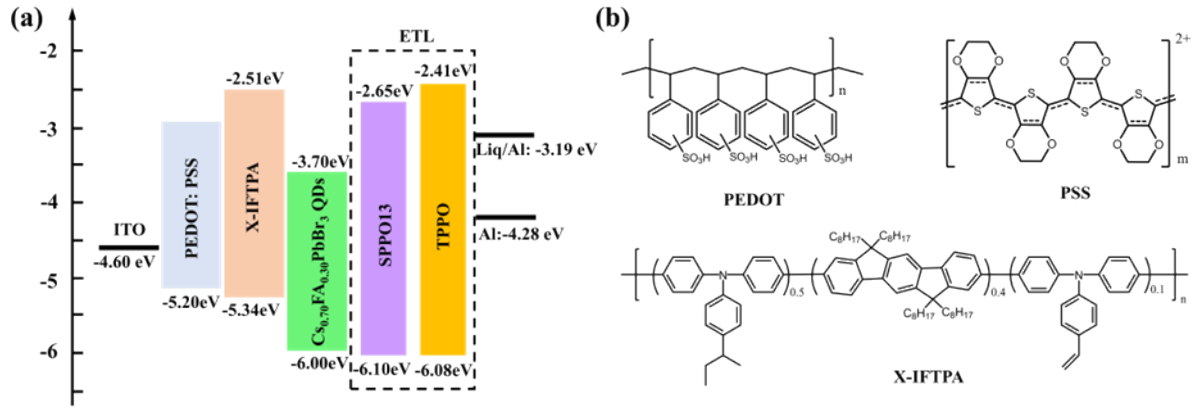

Fig. S6 Energy diagram of the PeQLEDs (a). The molecular structure of PEDOT:PSS, and X-IFTPA (b).

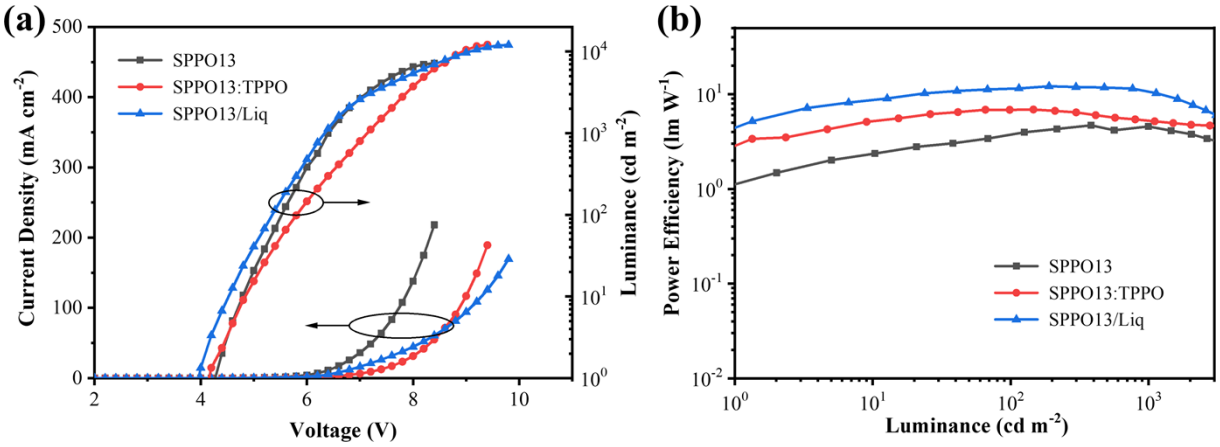

Fig. S7 Current density–voltage-luminance (*J-V-L*) curves (a) and power efficiency as a function of luminance (b) for the PeQLEDs.

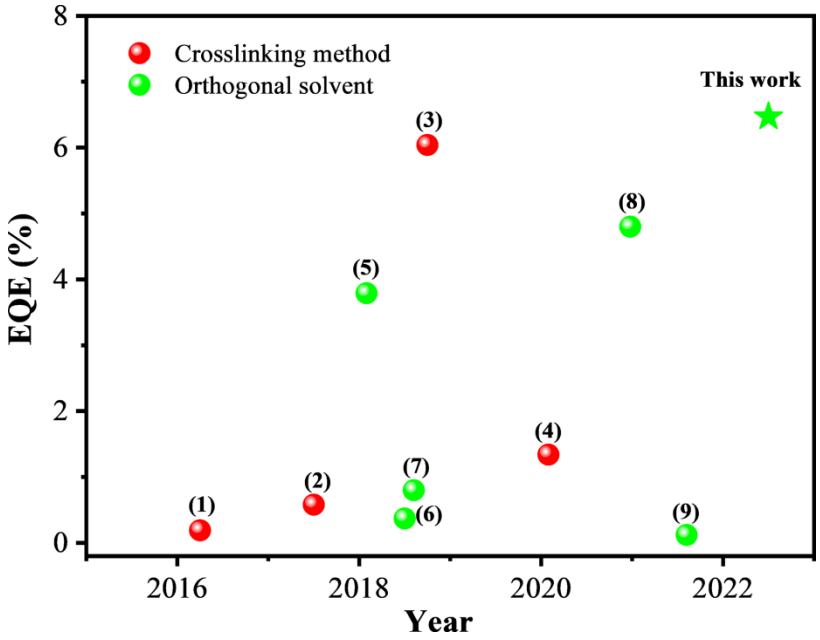

Fig. S8 Comparation of EQE of all-solution-processed PeQLEDs based on different processing methods in recent years.

Table S2. Summary of device performance of all-solution-processed PeQLEDs based on different processing methods in recent years.

Device structure	Processing method	λ_{EL} (nm)	L (cd m^{-2})	CE (cd A^{-1})	PE (lm W^{-1})	EQE (%)	Ref.
ITO/ZnO/$CsPbX_3$ QDs /TFB/MoO_3/Ag	Crosslinking	523	2335	-	-	0.19	(1) *Adv. Mater.* **2016**, 28, 3528.
ITO/TiO_2/Al_2O_3/$MAPbBr_3$ QDs/F8/MoO_3/Al	Crosslinking	528	7200	2.47	-	0.58	(2) *Adv. Mater.* **2017**, *29*, 1701153
ITO/ZnO/$FAPbBr_3$ QDs /PVK/PTPDPt	Crosslinking	519	12 998	20.53	-	6.04	(3) *Chem. Mater.* **2018**, *30*, 6231.
ITO/PeDOT:PSS/Poly-TPD /$CsPbX_3$ QDs/TPBi/LiF/Al	Crosslinking	513	2470	4.19		1.34	(4) *J. Phys. Chem. Lett.* **2020**, *11*, 1154.
ITO/NiO/$CsPbBr_3$ QDs/ZnO/Al	Orthogonal solvent	519	6093.2	7.96	4.26	3.79	(5) *ACS Nano* **2018**, *12*, 1462.
ITO/PeDOT:PSS/Poly-TPD /$CsPbBr_3$ QDs/ZnO/Al	Orthogonal solvent	510	1661	0.72	0.75	0.37	(6) *Nano Energy* **2018**, *51*, 358.
ITO/PeDOT:PSS/Poly-TPD /$MAPbBr_3$ QDs/TPBi/Ag	Orthogonal solvent	521	2266	3.26	-	0.8	(7) *ACS Appl. Mater. Interfaces* **2018**, *10*, 27374.
ITO /NiO /Zn-doped $CsPbBr_3$/ZnS QDs /ZnO /Ag	Orthogonal solvent	515	8600	-	-	4.8	(8) *J. Mater. Sci.* **2021**, *56*, 4161.
ITO/PEDOT:PSS/poly-TPD /PTAA /core−shell PeQDs /AlZnO /LiF/Al	Orthogonal solvent	515	3200	5.3	-	0.12	(9) *ACS Appl. Mater. Interfaces* **2021**, *13*, 29798.
ITO/PeDOT:PSS/X-IFTPA /$CsPbX_3$ QDs/ SPPO13/Liq/Al	Orthogonal solvent	520	12058.6	24.1	12.1	6.47	This work

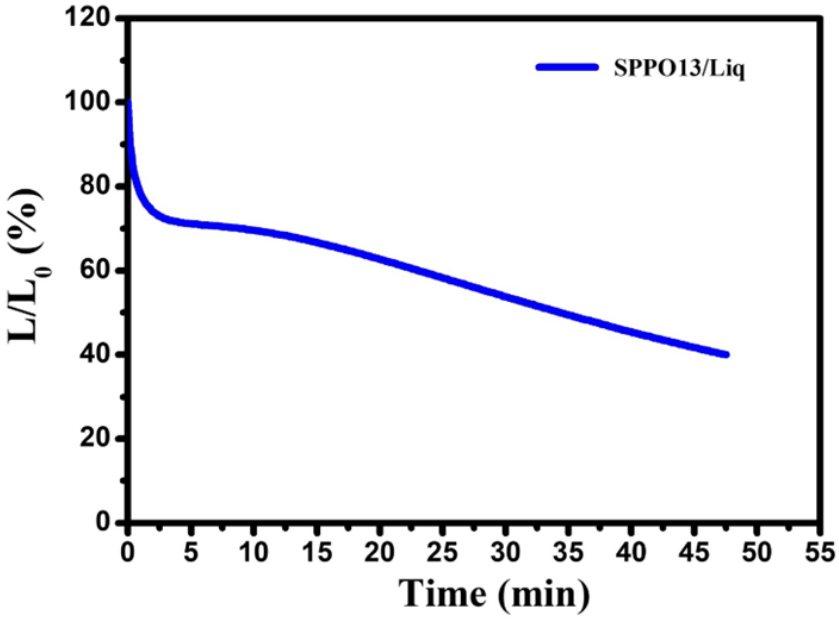

Fig. S9 Lifetime curve of the all-solution-processed PeQLEDs using SPO13 and Liq as the electron transporting layer and electron injection layer. Lifetime was measured at initial luminance of 100 cd/m^2.