

## Supporting Information

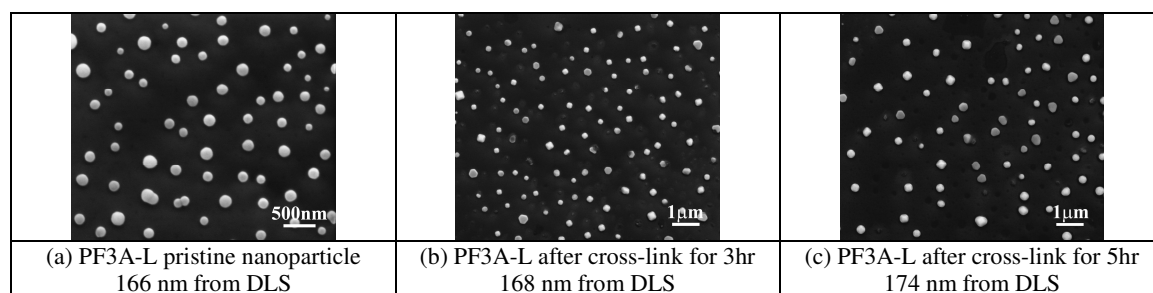
### White-emitting conjugated polymer nanoparticles with cross-linked shell for mechanical stability and controllable photometric properties in colour-conversion LED applications

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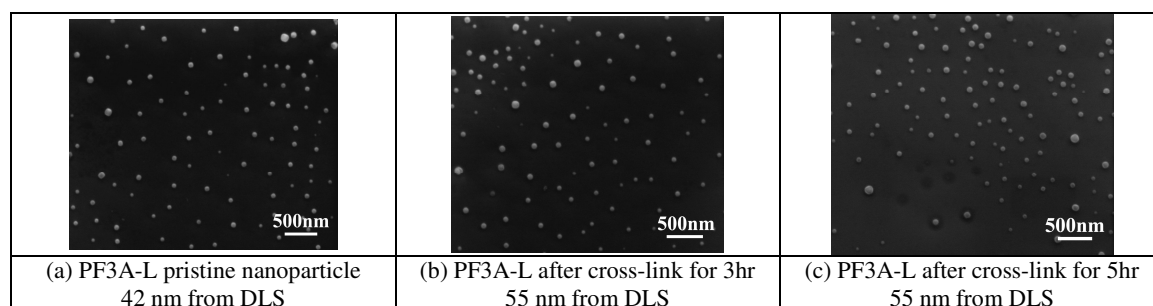
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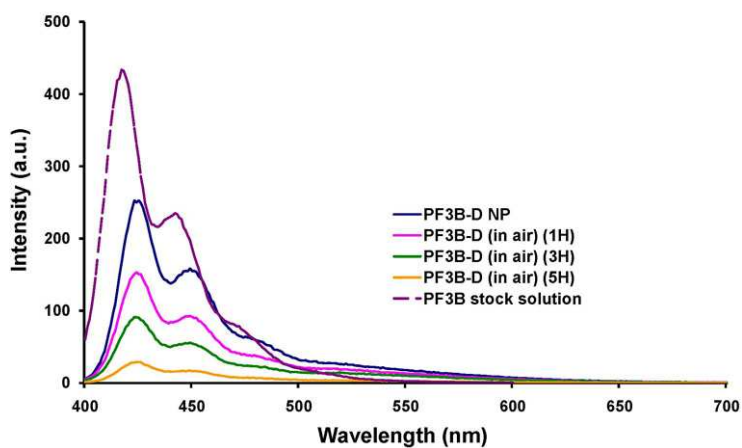
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**Figure S1.** SEM images of PF3A-L NP before and after cross-linking.



**Figure S2.** SEM images of PF3A-S NP before and after cross-linking.



**Figure S3.** Fluorescence spectra of PF3B stock solution, PF3B-S NP dispersions before and after cross-linking in the air.

**Table S1.** DLS results of cross-linked nanoparticle PF3A-L, PF3A-S and PF3B-S in air.

Sample	Before cross-link (nm)	After cross-link (nm)	
		3hrs	5hrs
<b>PF3A-L</b>	166 (0.133)*	168 (0.147)*	174 (0.146)*
<b>PF3A-S</b>	42 (0.186)*	55 (0.174)*	55 (0.273)*
<b>PF3B-S</b>	52 (0.183)*	54 (0.174)*	53 (0.207)*

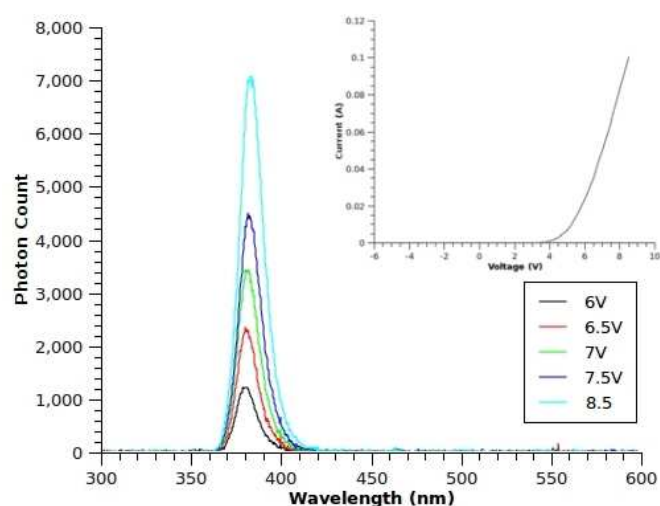
\* PDI : Size distribution by DLS

**Table S2.** Photometric computation results of PF3A-L dispersions for different cross-linking durations.

<b>Sample</b>	<b>CCT [K]</b>	<b>LER [lm/W]</b>	<b>S/P</b>	<b>x</b>	<b>y</b>
<b>PF3A-L NP</b>	N/A	188	4.56	0.1928	0.1838
<b>PF3A-L NP (1H, in air)</b>	N/A	203	4.51	0.1879	0.2065
<b>PF3A-L NP (2H, in air)</b>	N/A	199	4.27	0.1985	0.1960
<b>PF3A-L NP (3H, in air)</b>	N/A	207	4.08	0.2029	0.2057
<b>PF3A-L NP (4H, in air)</b>	N/A	224	3.72	0.2127	0.2243
<b>PF3A-L NP (5H, in air)</b>	N/A	235	3.55	0.2187	0.2380
<b>PF3A-L NP (6H, in air)</b>	52117	247	3.38	0.2249	0.2523
<b>PF3A-L NP (1H, under N<sub>2</sub>)</b>	N/A	192	4.42	0.1955	0.1879
<b>PF3A-L NP (2H, under N<sub>2</sub>)</b>	N/A	203	4.48	0.1887	0.2064
<b>PF3A-L NP (3H, under N<sub>2</sub>)</b>	N/A	203	4.18	0.2006	0.2013
<b>PF3A-L NP (4H, under N<sub>2</sub>)</b>	N/A	201	4.16	0.2007	0.1982
<b>PF3A-L NP (5H, under N<sub>2</sub>)</b>	N/A	228	3.68	0.2134	0.2311
<b>PF3A-L NP (6H, under N<sub>2</sub>)</b>	24231	260	3.22	0.2314	0.2687

**Table S3.** Photometric calculation results of PF3A-S dispersions at different cross-link durations.

Sample	CCT (K)	LER (lm/W)	S/P	x	y
PF3A-S NP	N/A	165	4.45	0.1950	0.1720
PF3A-S NP (1H, in air)	N/A	220	3.42	0.2216	0.2364
PF3A-S NP (2H, in air)	8462	299	2.59	0.2662	0.3347
PF3A-S NP (3H, in air)	7733	311	2.45	0.2750	0.3489
PF3A-S NP (4H, in air)	7293	320	2.37	0.2813	0.3602
PF3A-S NP (5H, in air)	6090	349	2.11	0.3075	0.3987
PF3A-S NP (6H, in air)	5835	355	2.04	0.3155	0.4071
PF3A-S NP (1H, under N <sub>2</sub> )	15286	263	2.95	0.2428	0.2893
PF3A-S NP (2H, under N <sub>2</sub> )	13261	272	2.91	0.2463	0.3019
PF3A-S NP (3H, under N <sub>2</sub> )	7865	310	2.49	0.2727	0.3476
PF3A-S NP (4H, under N <sub>2</sub> )	7109	324	2.35	0.2842	0.3660
PF3A-S NP (5H, under N <sub>2</sub> )	6490	342	2.22	0.2964	0.3881
PF3A-S NP (6H, under N <sub>2</sub> )	6257	353	2.19	0.3013	0.4033



**Figure S4.** Emission spectrum and IV characteristics (inset) of n-UVLED under different driving bias.