

Supporting Information

Residual-solvent-induced morphological transformation
by intense pulsed light on spin-coated and inkjet-printed
ZnO NP films for quantum-dot light-emitting diodes

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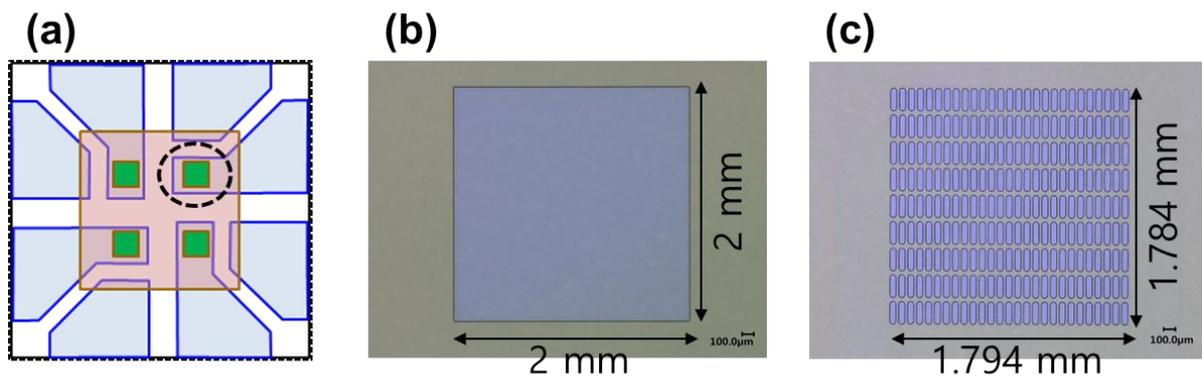


Figure S1. Device substrate with four emitting areas with an insulator thickness of 1.5 μm (a). An optical microscope image of an emitting layer 2 mm x 2 mm in size without a pixel define layer (PDL) for the spin-coating device (b) and 1.784mm x 1.794mm in size with a PDL for the inkjet-printing device (c).

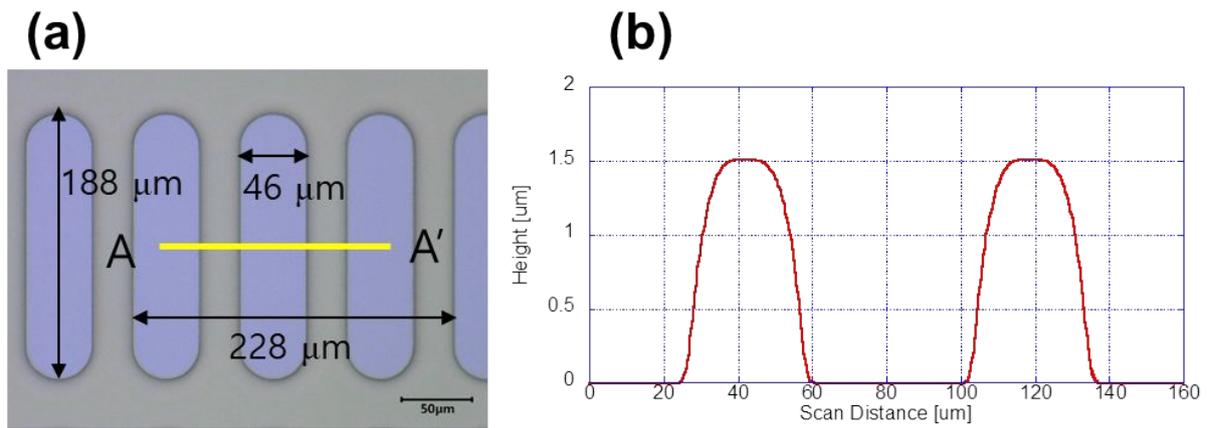


Figure S2. An optical microscope image of the PDL for the inkjet-printing device (a) and the depth profile measured by the alpha-step method at A-A' (b).

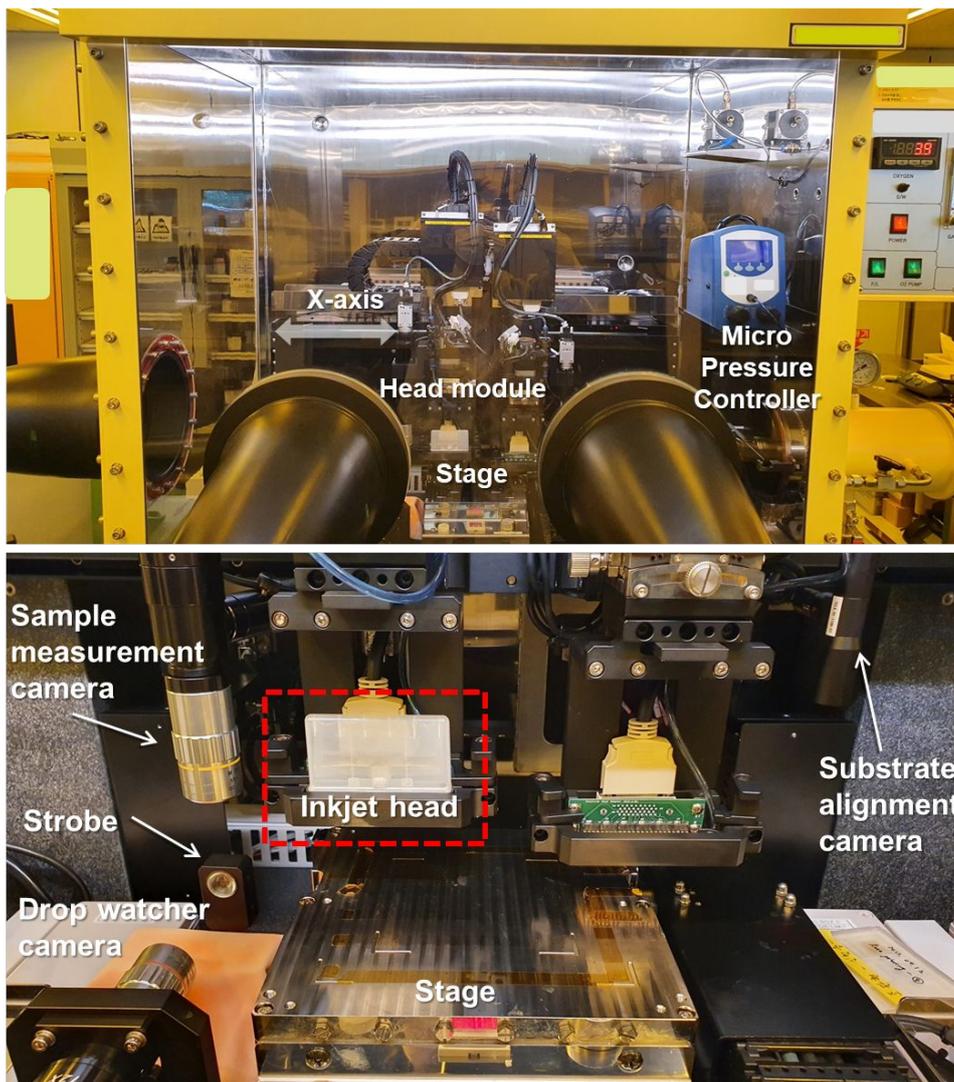


Figure S3. The outside (upper) and the inside (lower) of the inkjet-printing system (Marvel Engineering, Korea) equipped in a glove box.

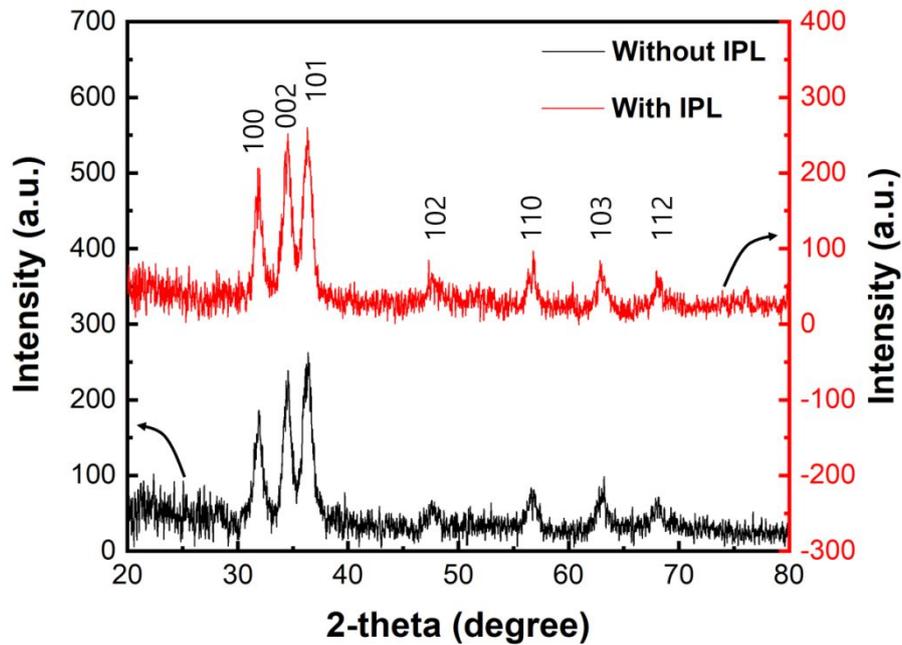


Figure S4. X-ray diffraction (XRD) analysis of the ZnO NPs thin-film without and with IPL post-treatment. Multi-Purpose Thin-Film X-Ray Diffractometer (Rigaku Americas Corporation, USA) was used for the analyzing the grazing incidence X-ray diffraction (GI-XRD).

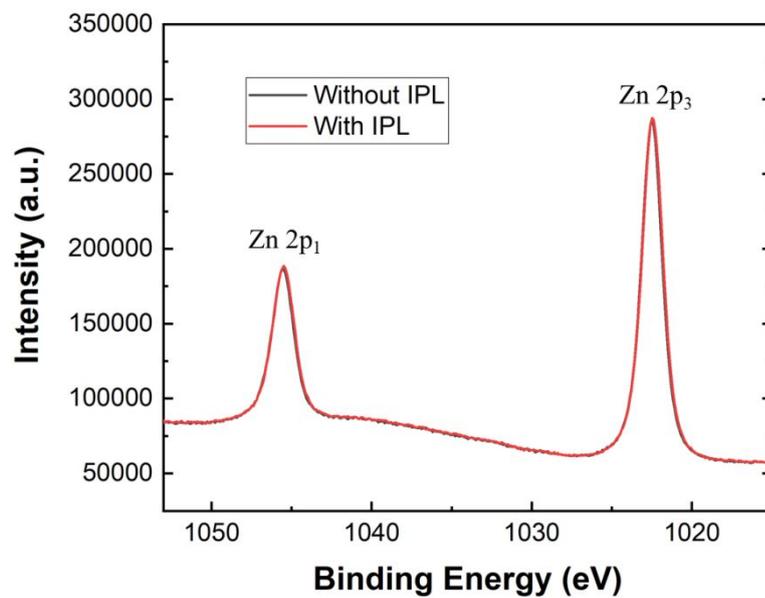


Figure S5. X-ray photoelectron spectroscopy (XPS) of Zn 2p without and with IPL post-treatment. A K-alpha+ XPS (Thermo Fisher Scientific, USA) was used to measure the binding energies.

Table S1. Luminance and efficiency characteristics of spin-coated and inkjet-printed QLEDs depending on the annealing temperature condition.

	Annealing temperature condition	Spin coated QLED	Inkjet printed QLED
Luminance (cd/m²)	0 °C	61,558	Not measured
	40 °C	68,038	Not measured
	60 °C	115,337	33,847
	80 °C	107,606	41,535
	100 °C	68,911	25,316
CE (cd/A)	0 °C	21.5407	Not measured
	40 °C	21.1087	Not measured
	60 °C	29.8512	7.4888
	80 °C	27.5038	8.8746
	100 °C	23.6985	6.6898
EQE (%)	0 °C	5.472	Not measured
	40 °C	5.464	Not measured
	60 °C	7.477	2.126
	80 °C	7.128	2.472
	100 °C	6.142	1.683

Table S2. Luminance and efficiency characteristics of spin-coated QLEDs depending on the individual annealing temperature conditions from the initial to the eighth day.

Annealing temperature condition	Measured day	Luminance (cd/m²)	CE (cd/A)	EQE (%)
0 °C	Initial	61,558	21.5407	5.472
	After 1 day	43,699	18.6572	4.950
	After 2 days	35,682	17.9846	4.604
	After 4 days	24,010	14.3781	3.755
	After 6 days	Not measured		
	After 8 days	Not measured		
40 °C	Initial	68,038	21.1087	5.464
	After 1 day	65,837	21.6230	5.604
	After 2 days	61,242	20.8573	5.535
	After 4 days	54,879	20.9172	5.465
	After 6 days	38,505	19.3967	5.068
	After 8 days	30,702	18.2397	4.718
60 °C	Initial	115,337	29.8320	7.731
	After 1 day	114,822	30.3880	7.977
	After 2 days	110,845	29.5113	7.711
	After 4 days	106,117	29.8135	7.826
	After 6 days	104,996	29.8786	7.809
	After 8 days	100,409	29.2911	7.561
80 °C	Initial	107,606	27.5038	7.128
	After 1 day	106,430	27.6264	7.159
	After 2 days	104,676	29.0269	7.325
	After 4 days	100,850	28.6825	7.491
	After 6 days	90,348	28.1634	7.355
	After 8 days	88,874	28.0074	7.094
100 °C	Initial	68,911	23.6985	6.142
	After 1 day	64,582	23.1606	6.002
	After 2 days	56,407	23.3805	6.106

After 4 days	52,040	23.6257	6.174
After 6 days	44,690	22.9411	5.996
After 8 days	40,885	23.3731	5.684

Table S3. Luminance and efficiency characteristics of inkjet-printed QLEDs depending on the individual annealing temperature conditions from the initial to the eighth day.

Annealing temperature condition	Measured day	Luminance (cd/m²)	CE (cd/A)	EQE (%)
60 °C	Initial	33,847	7.6266	2.182
	After 1 day	32,541	7.5695	2.173
	After 2 days	31,537	7.4701	2.104
	After 4 days	30,541	7.4572	2.098
	After 6 days	29,102	7.3003	2.053
	After 8 days	27,593	7.3945	2.124
	80 °C	Initial	41,535	8.8746
After 1 day		38,588	8.7786	2.473
After 2 days		37,614	8.7239	2.479
After 4 days		36,107	8.6588	2.446
After 6 days		33,479	8.4305	2.352
After 8 days		32,001	8.5132	2.405
100 °C		Initial	25,316	6.6898
	After 1 day	23,045	6.7389	1.639
	After 2 days	21,077	6.7667	1.677
	After 4 days	17,781	6.6113	1.606
	After 6 days	13,911	6.3716	1.537
	After 8 days	11,986	6.3811	1.572