

**Synergistic Enhancement of Near-infrared Luminescence Properties of Ni²⁺-
doped SrTiO₃ Perovskite Phosphors and Its Application**

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Table S1. Crystallographic parameters obtained from XRD Rietveld refinement of STO, STO-Ni, STO-Ni-M (M=La³⁺, Gd³⁺, Nd³⁺, and Yb³⁺), respectively.

	STO	STO-Ni	STO-Ni-La	STO-Ni-Gd	STO-Ni-Nd	STO-Ni-Yb
Crystal structure	Cubic	Cubic	Cubic	Cubic	Cubic	Cubic
Space group	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>
a, Å	3.9015	3.9032	3.9013	3.9007	3.9008	3.8992
V, Å ³	59.39	59.46	59.37	59.35	59.35	59.28
R _p %	4.15	5.73	5.74	4.99	6.27	5.11
R _{wp} %	4.13	5.94	5.71	7.43	6.81	5.32
χ ² %	2.33	2.17	2.89	2.90	2.51	2.35

Table S2. Crystallographic parameters obtained from XRD Rietveld refinement of STO-Ni-xYb (x=0.0025, 0.005, 0.0075, 0.01, 0.015, and 0.02), respectively.

	STO-Ni- 0.0025Yb	STO-Ni- 0.005Yb	STO-Ni- 0.0075Yb	STO-Ni- 0.01Yb	STO-Ni- 0.015Yb	STO-Ni- 0.02Yb
Crystal structure	Cubic	Cubic	Cubic	Cubic	Cubic	Cubic
Space group	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>
a, Å	3.9072	3.9019	3.8941	3.8916	3.8847	3.8755
V, Å ³	59.64	59.40	59.05	58.93	58.62	58.21
R _p %	5.44	7.63	4.98	5.39	7.07	6.51
R _{wp} %	5.44	4.84	8.75	6.13	5.81	6.90
χ ² %	2.47	2.66	2.97	3.05	2.85	2.16
Average length (Ti-O, Å)	1.9487	1.9492	1.9501	1.9505	1.9521	1.9528

Table S3. Crystallographic parameters obtained from XRD Rietveld refinement of STO-Ni-Yb-xTa (x=0.0025, 0.005, 0.0075, 0.01, 0.015, and 0.02), respectively.

	STO-Ni- Yb- 0.0025Ta	STO-Ni- Yb- 0.005Ta	STO-Ni- Yb- 0.0075Ta	STO-Ni- Yb-0.01Ta	STO-Ni- Yb- 0.015Ta	STO-Ni- Yb-0.02Ta
Crystal structure	Cubic	Cubic	Cubic	Cubic	Cubic	Cubic
Space group	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>	<i>Fm-3m</i>
R _p %	5.44	7.63	4.98	5.39	7.07	6.51
R _{wp} %	5.44	4.84	8.75	6.13	5.81	6.90
χ ² %	2.47	2.66	2.97	3.05	2.85	2.16
Average length (Ti-O, Å)	1.9486	1.9479	1.9471	1.9461	1.9452	1.9443
Distortion index	1.0642	1.0598	1.0426	1.029	1.0375	1.0847

Table S4. XRF results of the STO-Ni, STO-Ni-Yb and STO-Ni-Yb-Ta phosphors, respectively.

	STO	STO-Ni-Yb	STO-Ni-Yb-Ta
O,%	10.0486	13.5466	14.7463
Ti,%	24.9303	23.6434	21.9117
Sr,%	54.883	51.9832	48.2459
Ni,%	0.403	0.4257	0.4803
Yb,%		1.7895	1.1837
Ta,%			1.9746
Sum,%	90.2649	91.3884	88.5425

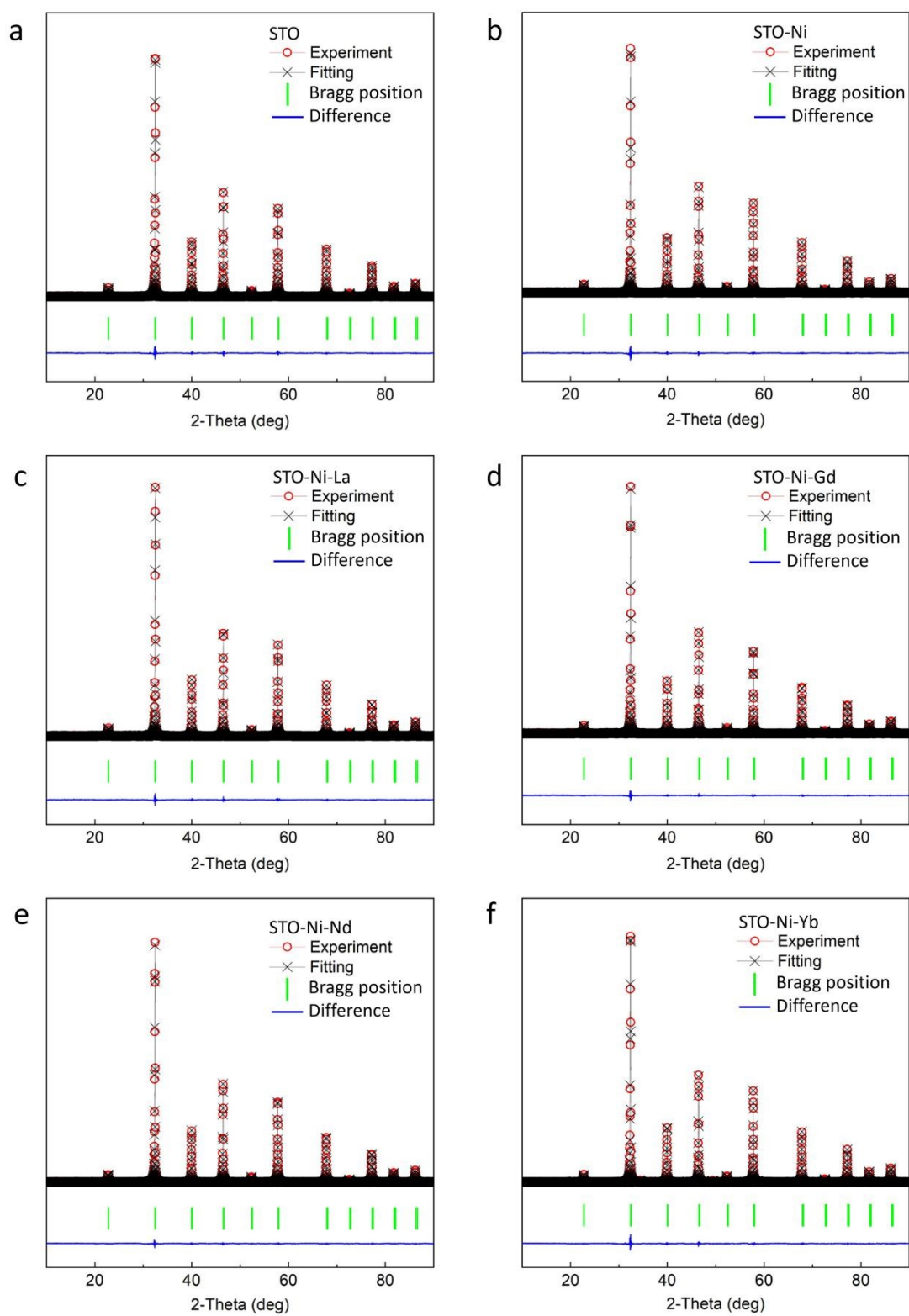


Figure S1. Rietveld refinement profiles of (a) STO, (b) STO-Ni, (c) STO-Ni-La, (d) STO-Ni-Gd, (e) STO-Ni-Nd, and (f) STO-Ni-Yb, respectively.

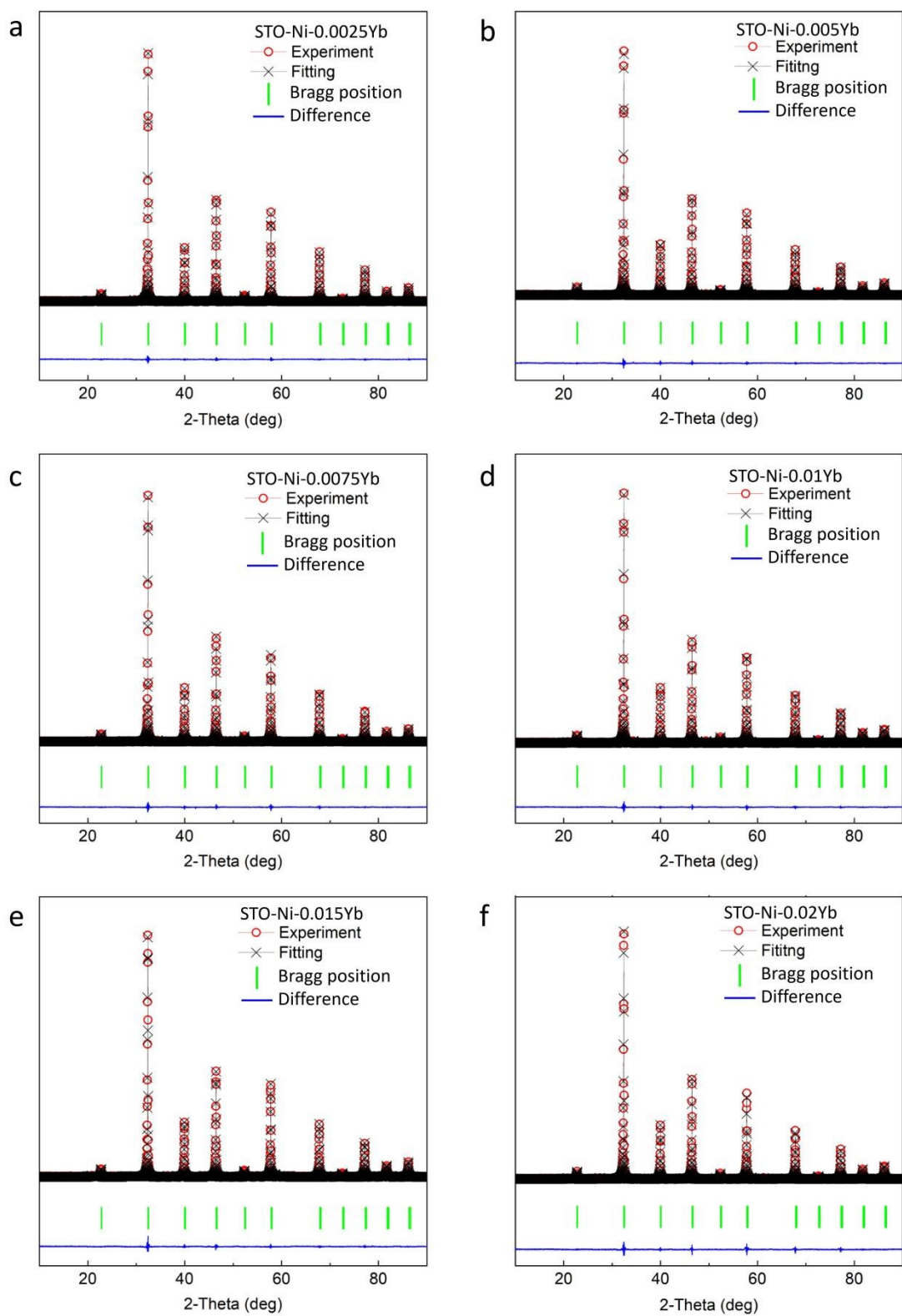


Figure S2. Rietveld refinement profiles of (a) STO-Ni-0.0025Yb, (b) STO-Ni-

0.005Yb, (c) STO-Ni-0.0075Yb, (d) STO-Ni-0.01Yb, (e) STO-Ni-0.015Yb, (f) STO-Ni-0.02Yb, respectively.

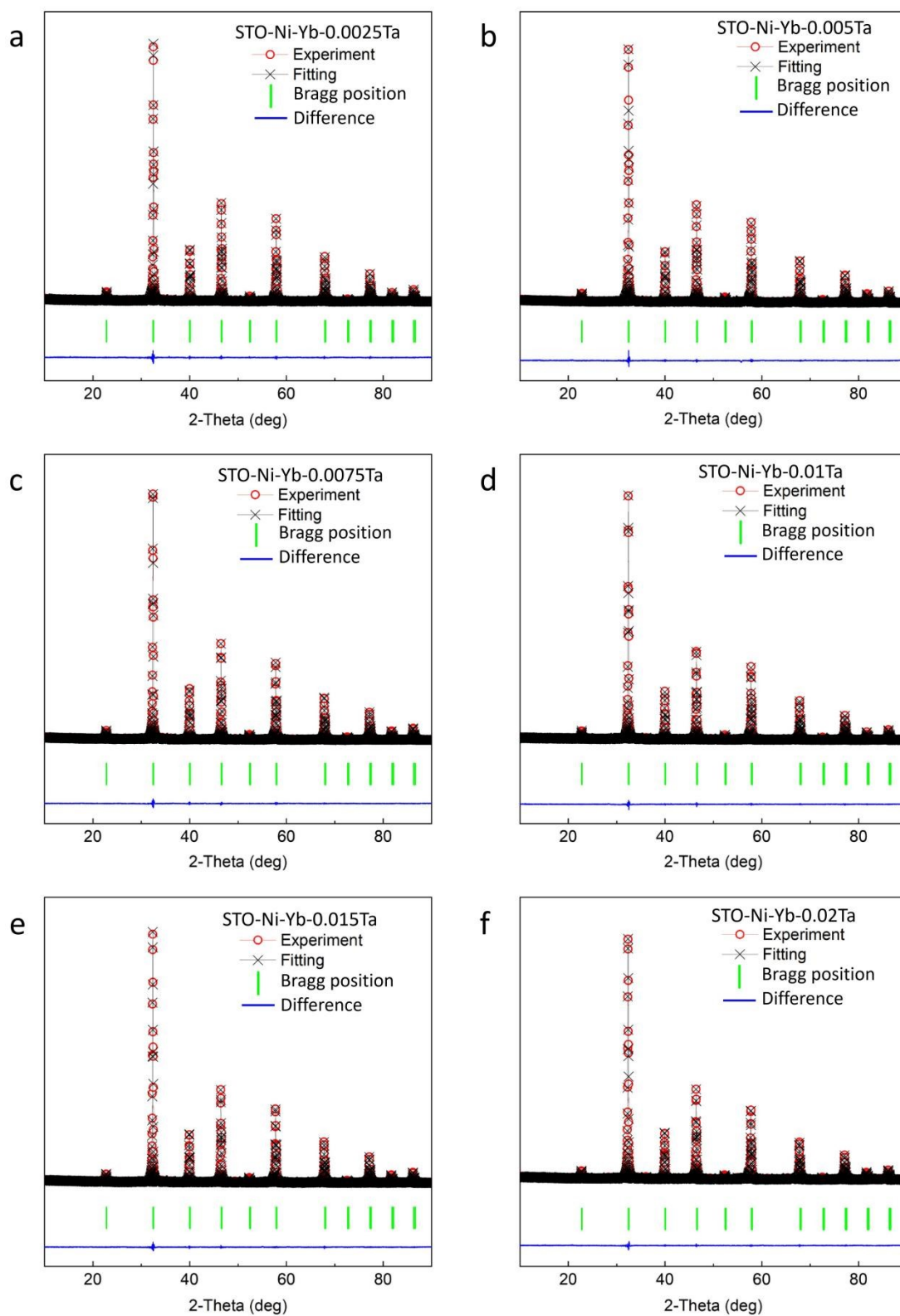


Figure S3. Rietveld refinement profiles of (a) STO-Ni-Yb-0.0025Ta, (b) STO-Ni-Yb-

0.005Ta, (c) STO-Ni-Yb-0.0075Ta, (d) STO-Ni-Yb-0.01Ta, (e) STO-Ni-Yb-0.015Ta, and (f) STO-Ni-Yb-0.02Ta, respectively.

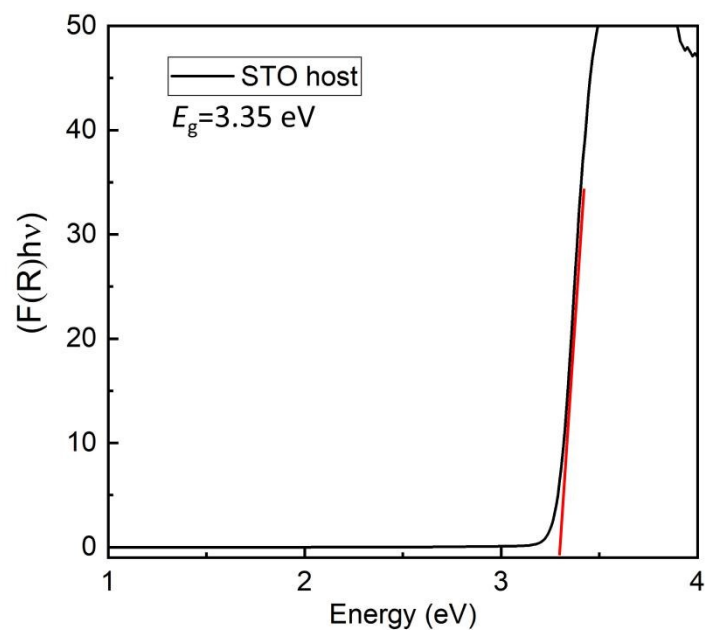


Figure S4. The plot of absorption coefficient against photon energy using SrTiO₃ host.

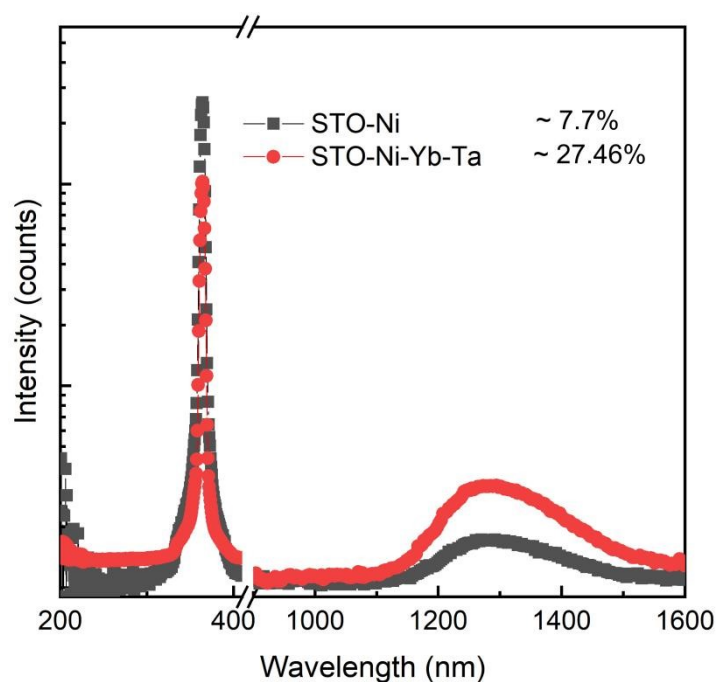


Figure S5. Measured PLQY profiles of STO-Ni and STO-Ni-Yb-Ta phosphors, respectively.

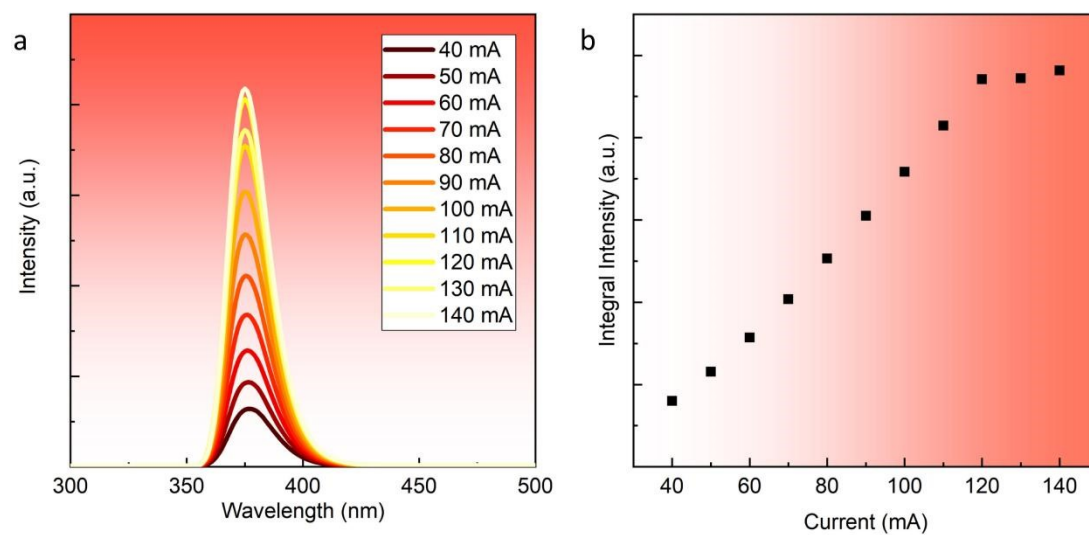


Figure S6. (a) Emission profiles and (b) integral intensities of UV LED chip only as a function of input-current power.

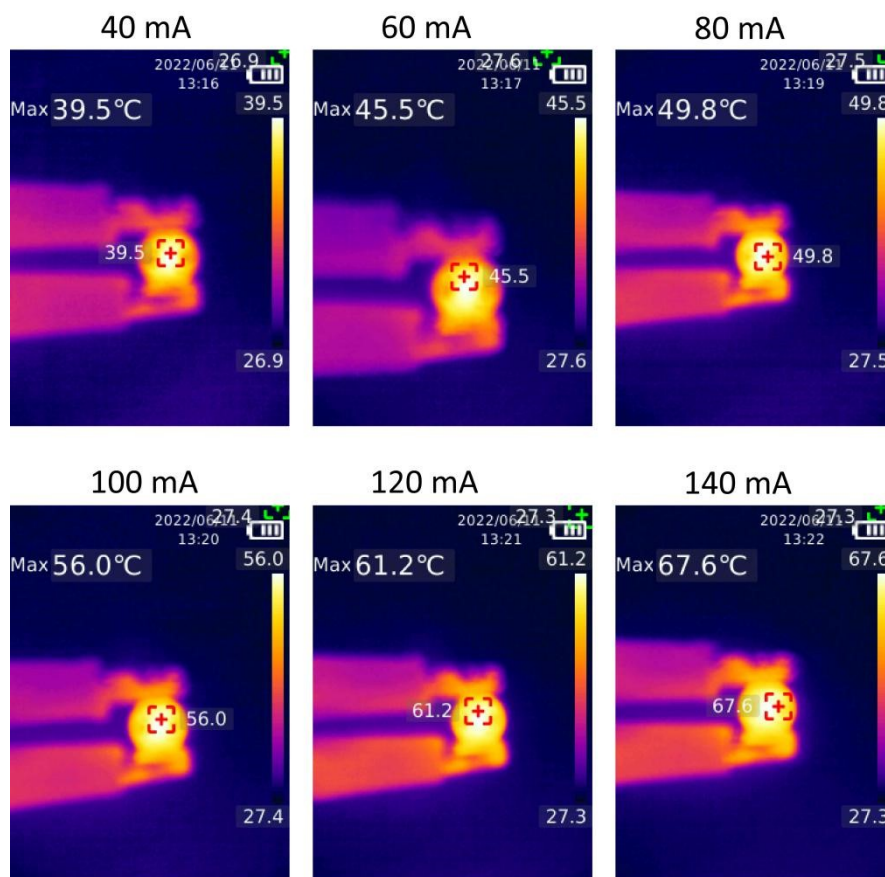


Figure S7. Thermography images recorded from the UV chip at different driven current.