

Towards highly sensitive and highly emissive luminescent thermometers for elevated temperatures based on lanthanide-doped polymers

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1. Complexes and polymers characterization

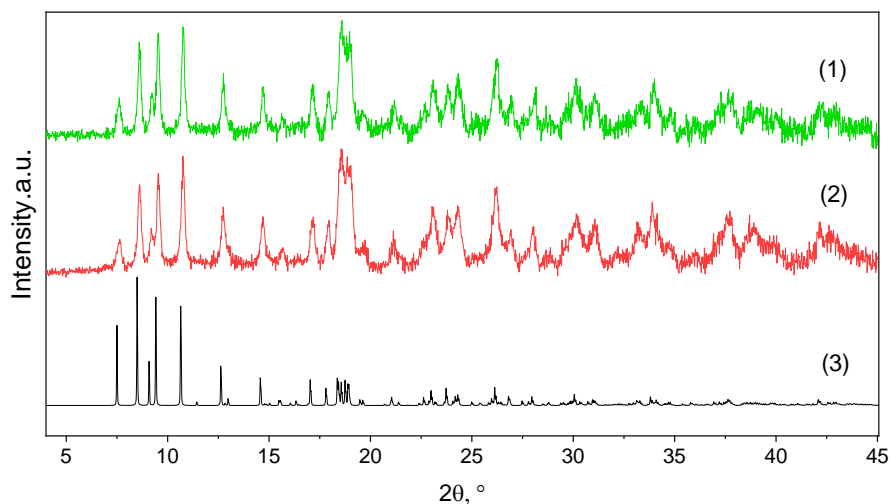


Figure S1 PXDR data of 1) Tb(Bz)₃Phen; 2) Eu(Bz)₃Phen; 3) theoretical PXDR pattern of Tb(Bz)₃Phen calculated from the crystal structure (CCDC identifier SAJGEQ).

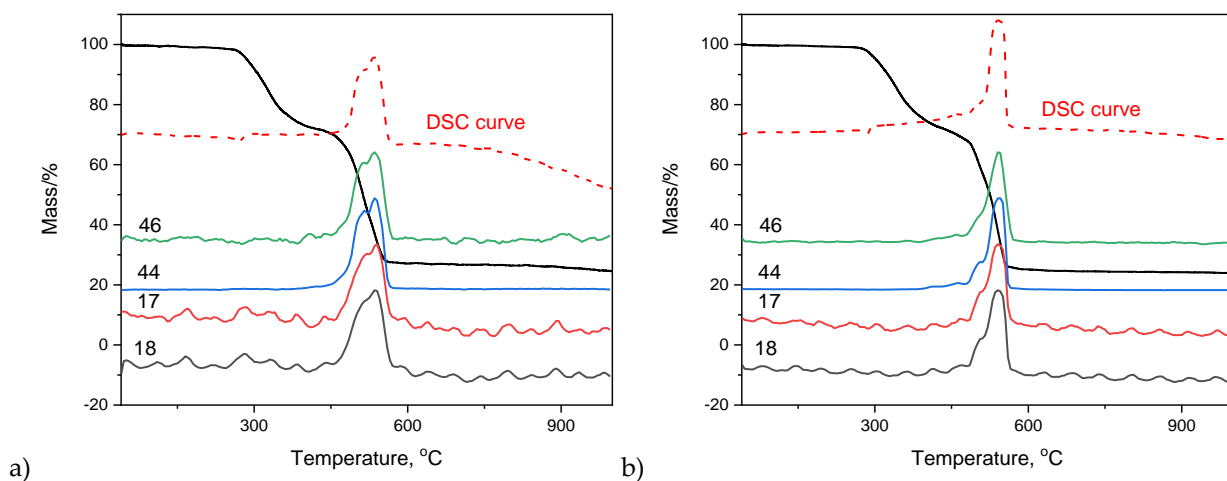
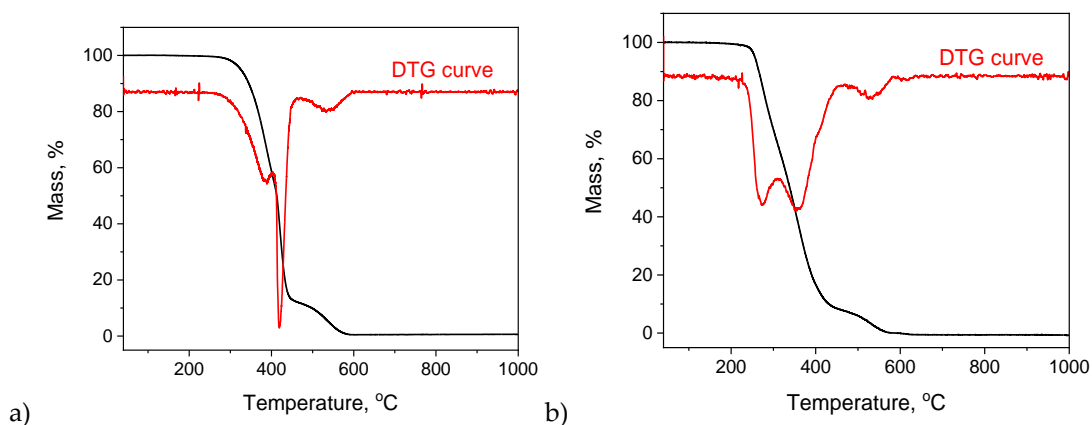


Figure S2 Thermal analysis with mass-detection of the evolved gases of a) Tb(Bz)₃Phen, b) Eu(Bz)₃Phen.



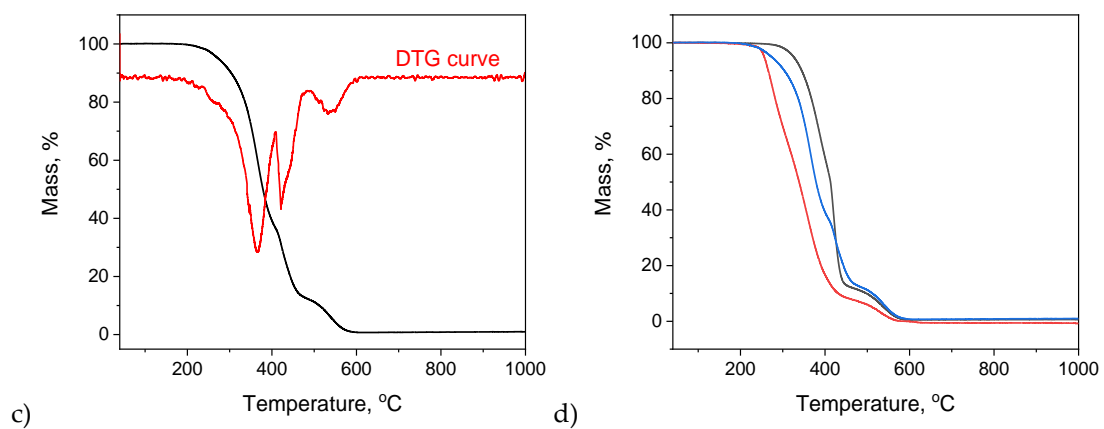


Figure S3 Thermal analysis (10 °C/min) of polymers: a) PI4050, b) PI2050, c) PI4072 and d) PI4050 (black), PI2050 (red), PI4072 (blue).

2. Composites characterization

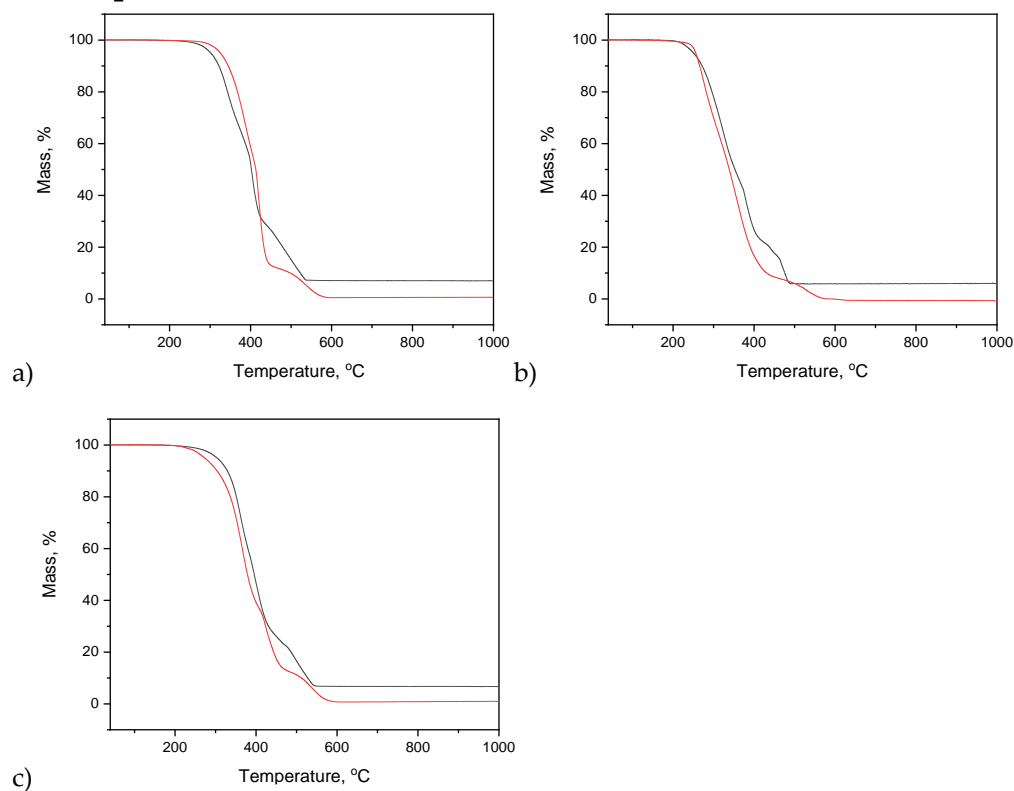


Figure S4 Thermal analysis of composite (black) and polymer (red) a) **LTPI1** and PI4050, b) **LTPI2** and PI2050, c) **LTPI3** and PI4072.

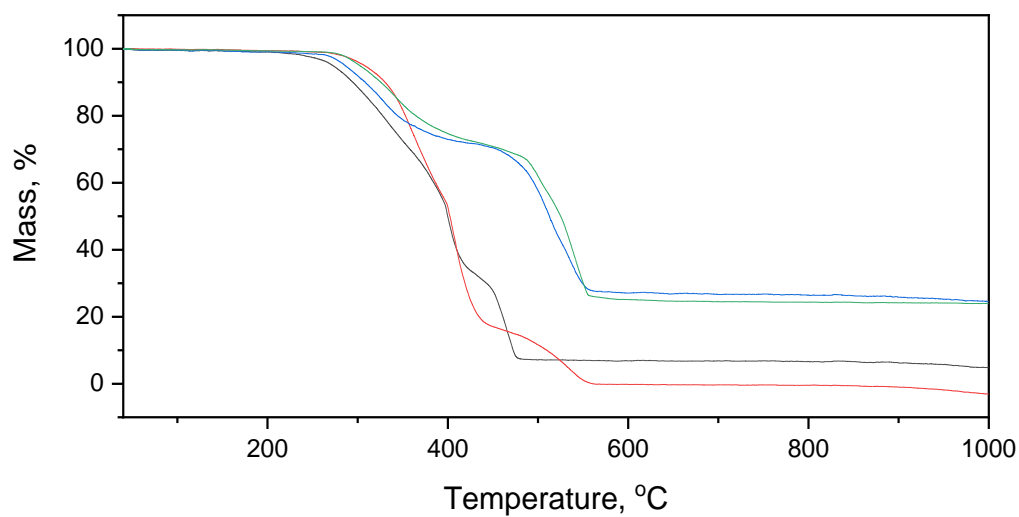


Figure S5 Thermal analysis (5 °C/min) of **LTPI1** (black), **PI4050** (red), **Tb(Bz)₃Phen** (blue), **Eu(Bz)₃Phen** (green).

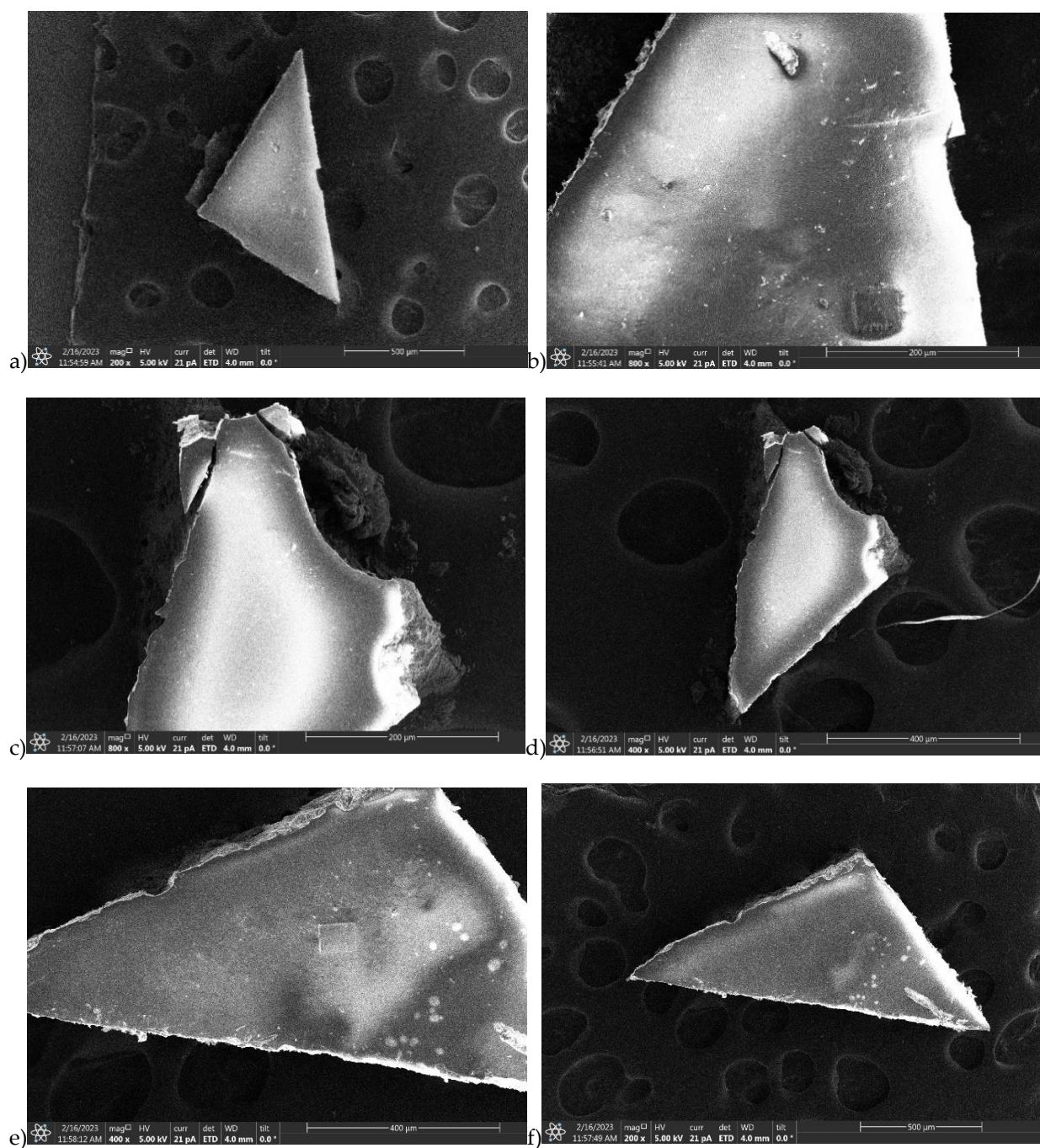
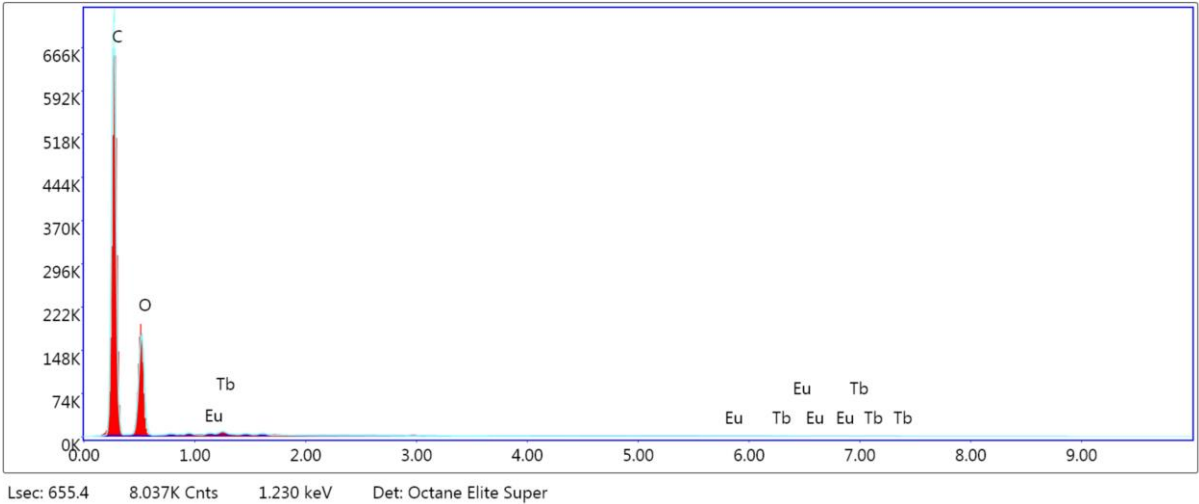


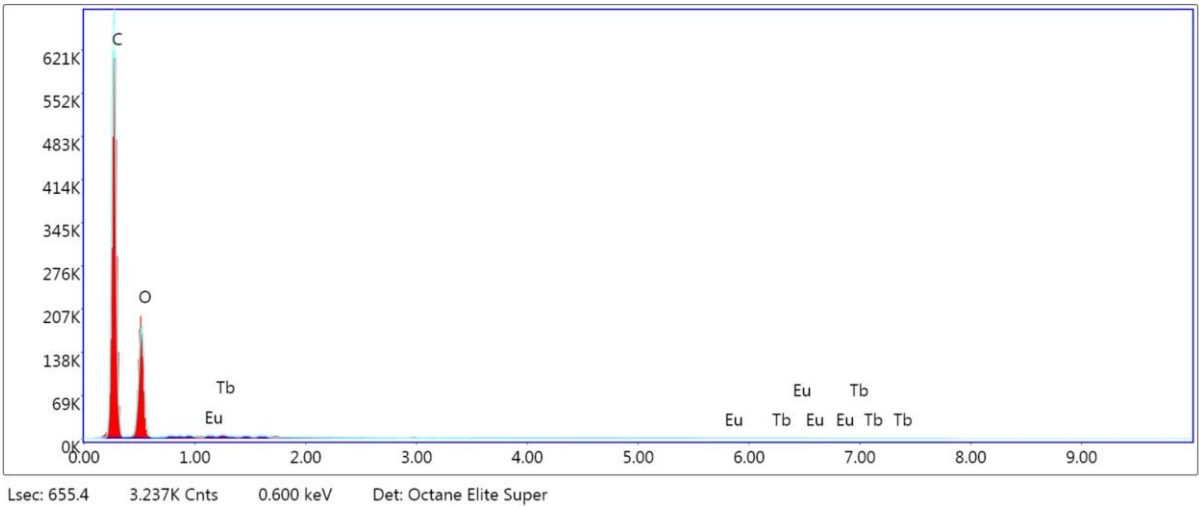
Figure S6 SEM data of a-b) LTPi1, c-d) LTPi2, e-f) LTPi3.

EDX data for LTP11



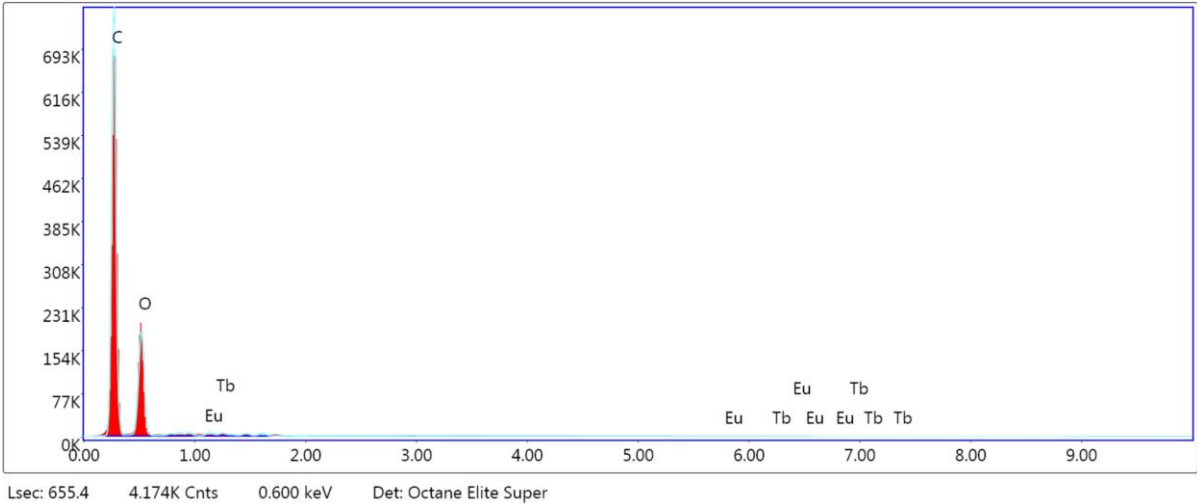
Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z	A	F
C K	67.8	74.1	5882.3	3.9	0.5112	1.0181	0.7405	1.0000
O K	31.5	25.9	1484.7	9.8	0.0624	0.9675	0.2045	1.0000
EuL	0.0	0.0	0.5	74.2	0.0002	0.5435	1.0719	1.0144
TbL	0.6	0.1	10.3	15.8	0.0036	0.5255	1.0645	1.0151

EDX data for LPT12



Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z	A	F
C K	66.7	72.8	5608.0	3.9	0.4989	1.0168	0.7353	1.0000
O K	33.1	27.2	1539.0	9.8	0.0658	0.9662	0.2055	1.0000
EuL	0.0	0.0	0.1	77.6	0.0000	0.5425	1.0726	1.0140
TbL	0.1	0.0	1.9	39.0	0.0007	0.5245	1.0665	1.0172

EDX data for LTPI3



Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z	A	F
C K	68.0	73.9	6337.4	3.8	0.5134	1.0159	0.7436	1.0000
O K	32.0	26.1	1601.2	9.9	0.0623	0.9653	0.2019	1.0000
EuL	0.0	0.0	0.3	68.4	0.0001	0.5420	1.0730	1.0140
TbL	0.0	0.0	0.5	61.8	0.0002	0.5239	1.0654	1.0177

3. Luminescence of composites

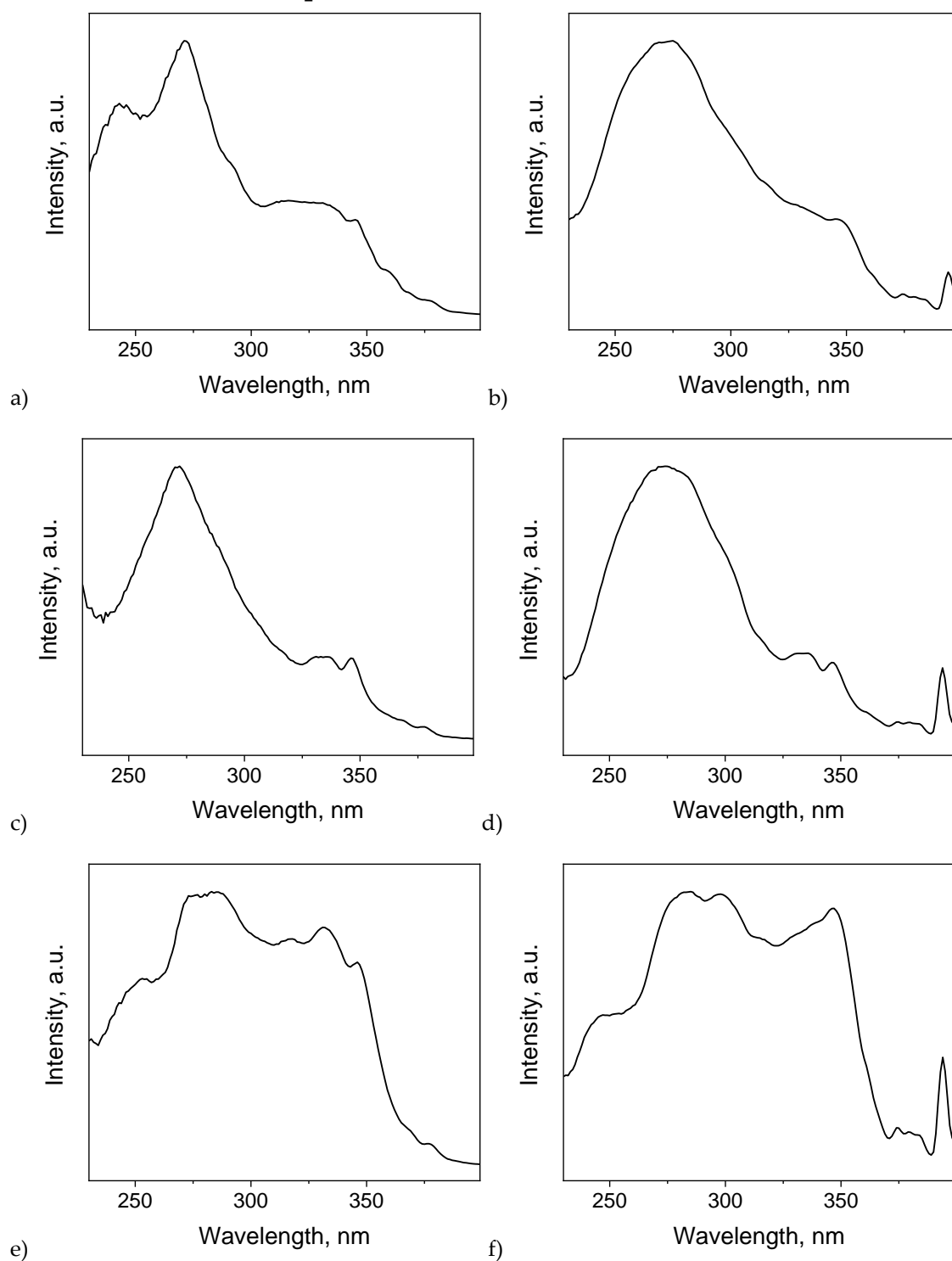
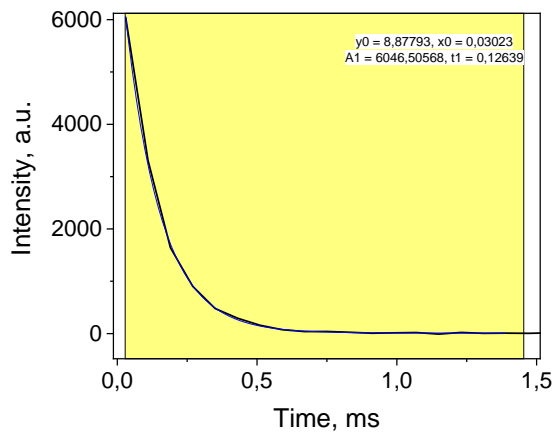
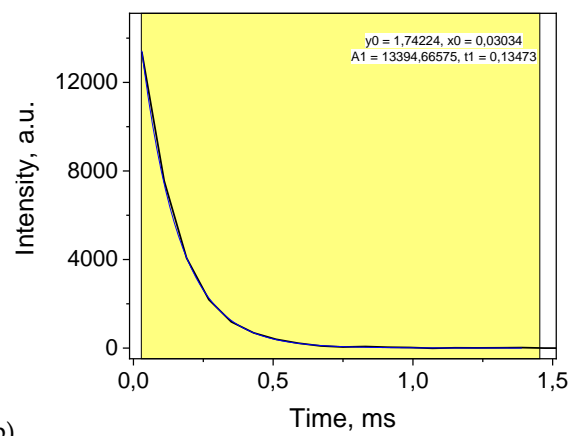


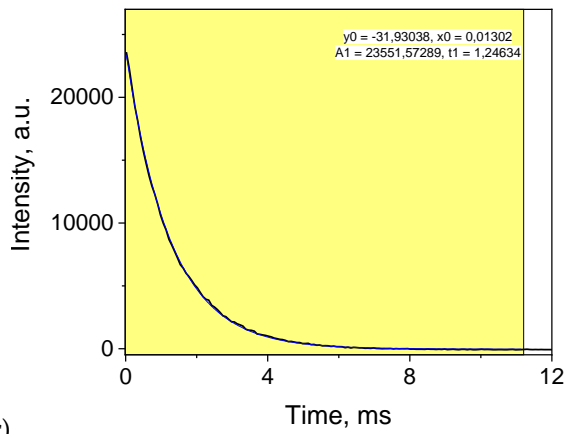
Figure S7 Excitation spectra of a) **LTPI1** ($\lambda_{em} = 543$ nm), b) **LTPI1** ($\lambda_{em} = 612$ nm), c) **LTPI12** ($\lambda_{em} = 543$ nm), d) **LTPI2** ($\lambda_{em} = 612$ nm), e) **LTPI13** ($\lambda_{em} = 543$ nm), f) **LTPI13** ($\lambda_{em} = 612$ nm).



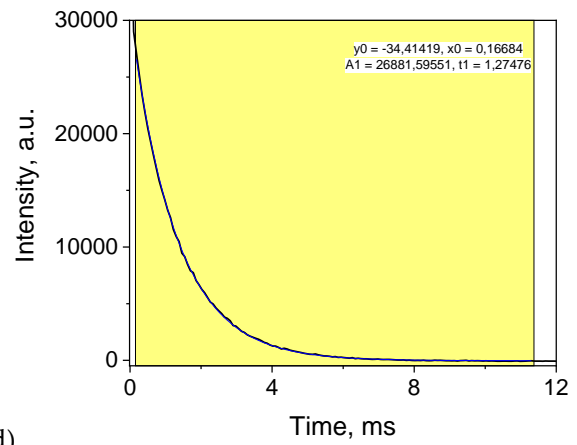
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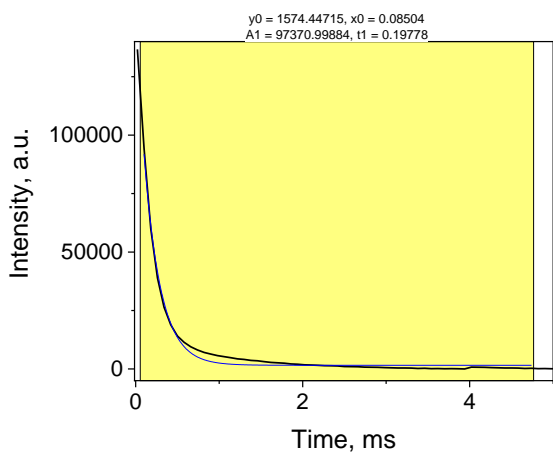
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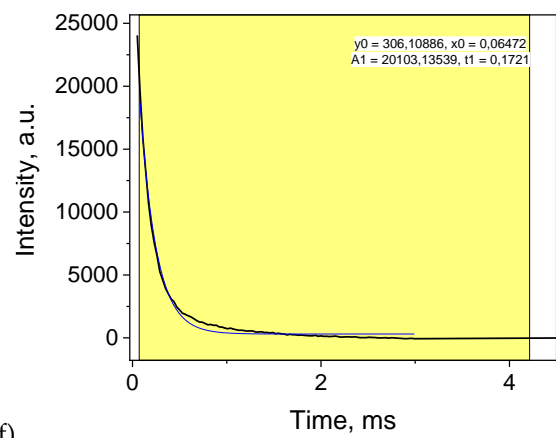
c)



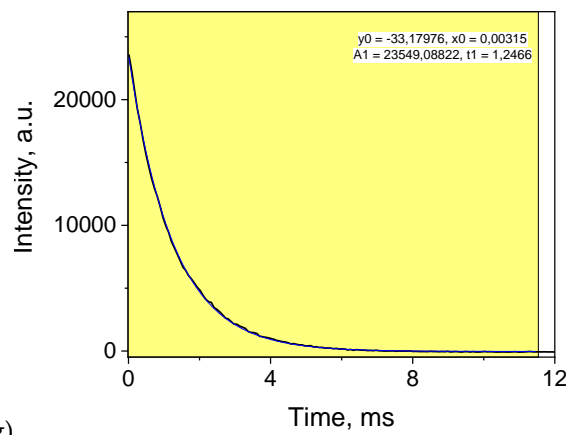
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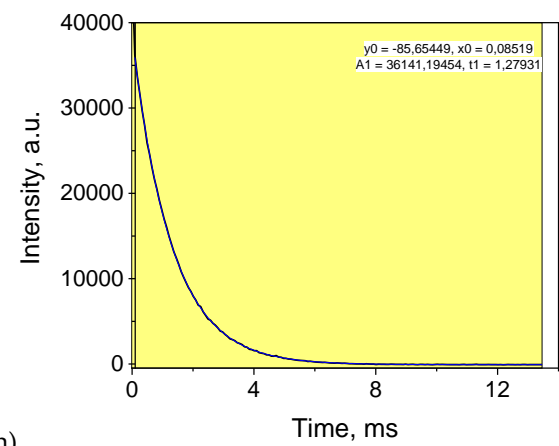
e)



f)



g)



h)

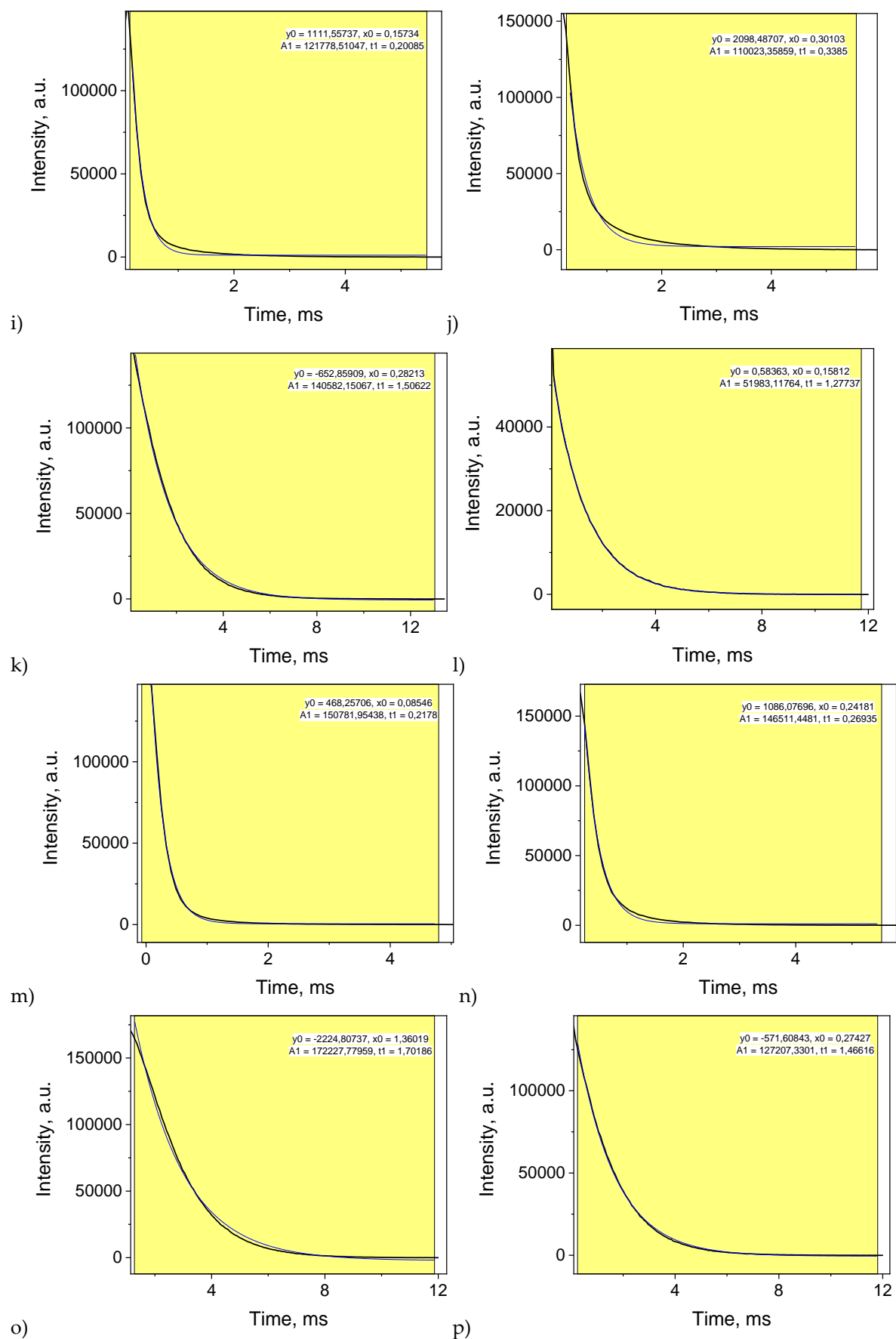
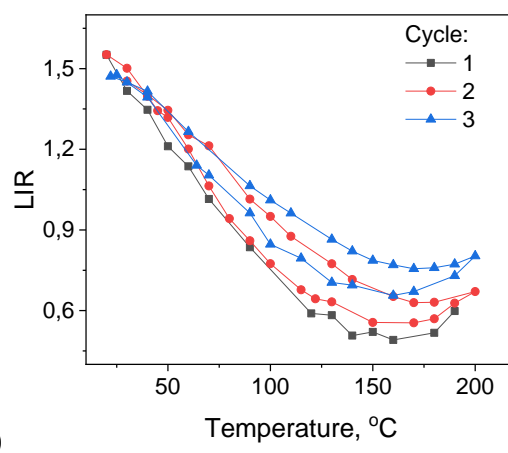
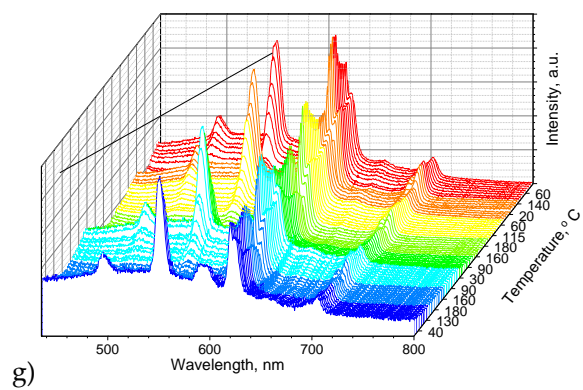
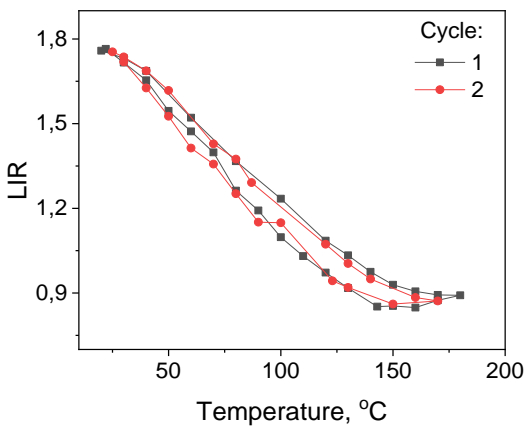
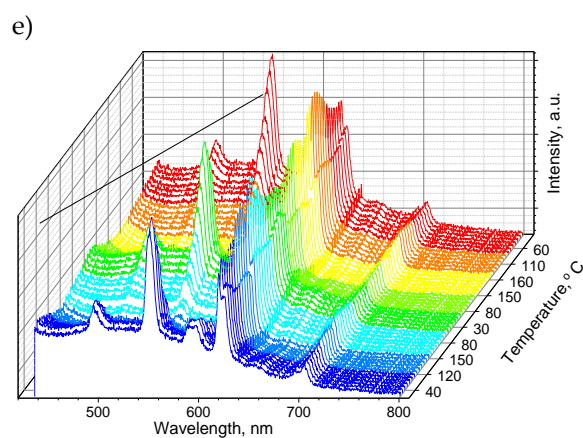
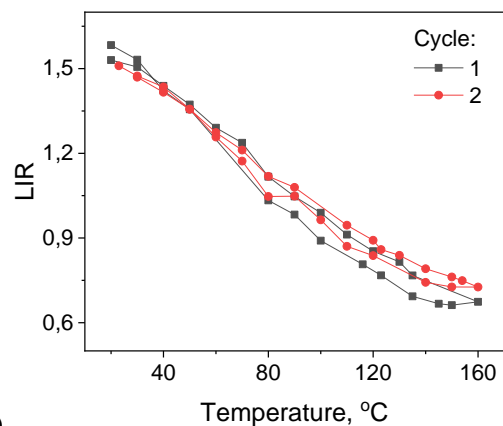
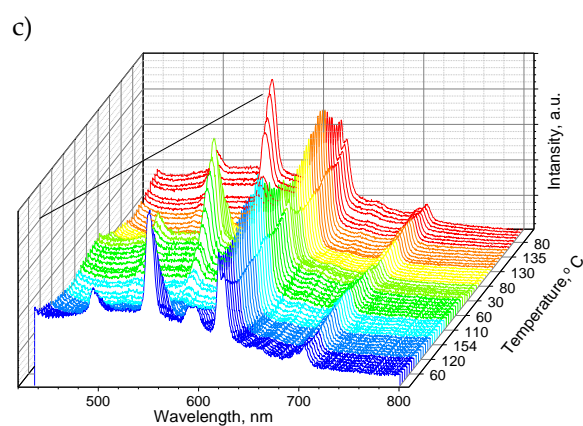
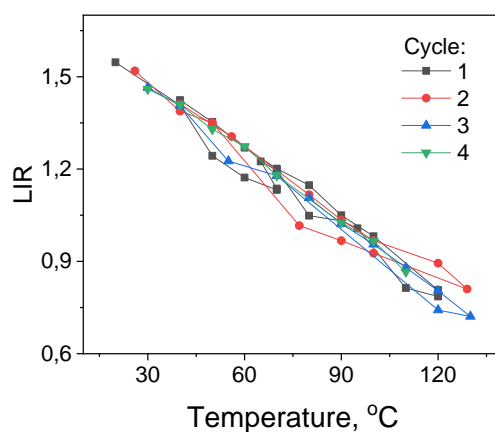
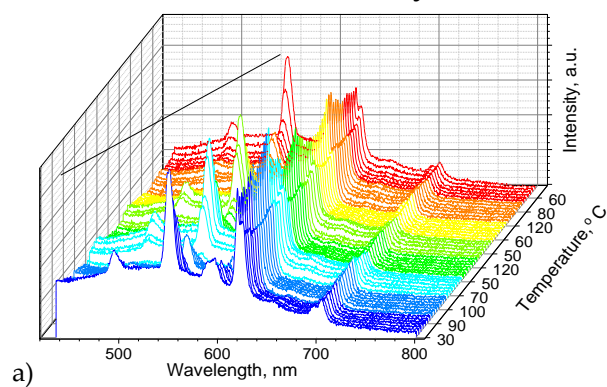


Figure S8 Lifetimes of a) Tb(Bz)₃Phen at 487 nm; b) Tb(Bz)₃Phen at 543 nm, c) Eu(Bz)₃Phen at 612 nm, d) Eu(Bz)₃Phen at 697 nm, e) LTPI1 at 487 nm, f) LTPI1 at 543 nm, g) LTPI1 at 612 nm, h) LTPI1 at 697 nm, i) LTPI2 at 487 nm, j) LTPI2 at 543 nm, k) LTPI2 at 612 nm, l) LTPI2 at 697 nm, m) LTPI3 at 487 nm, n) LTPI3 at 543 nm, o) LTPI3 at 612 nm, p) LTPI3 at 697 nm ($\lambda_{\text{ex}} = 350$ nm).

4. Luminescent thermometry



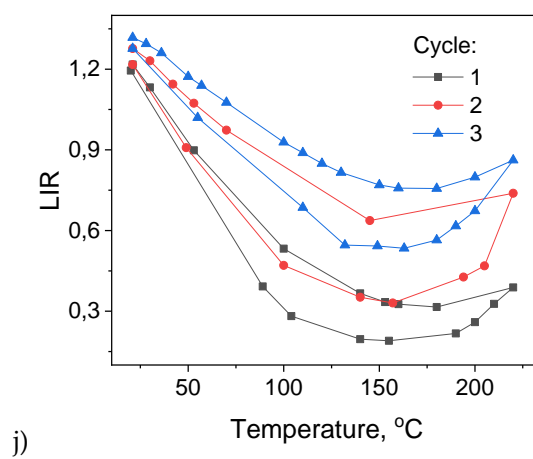
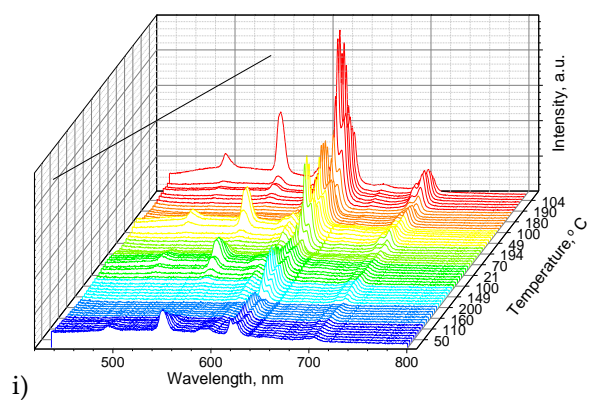
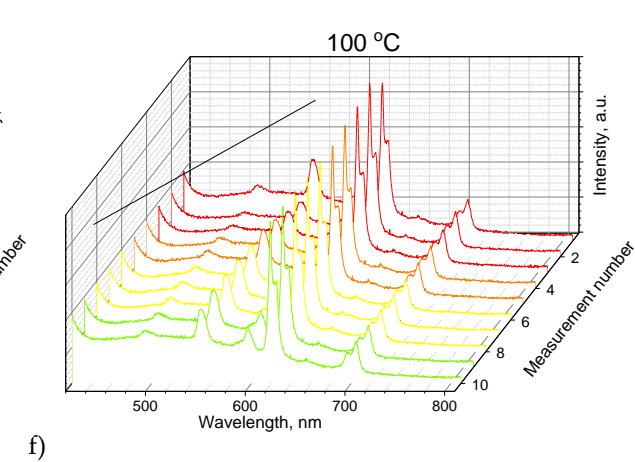
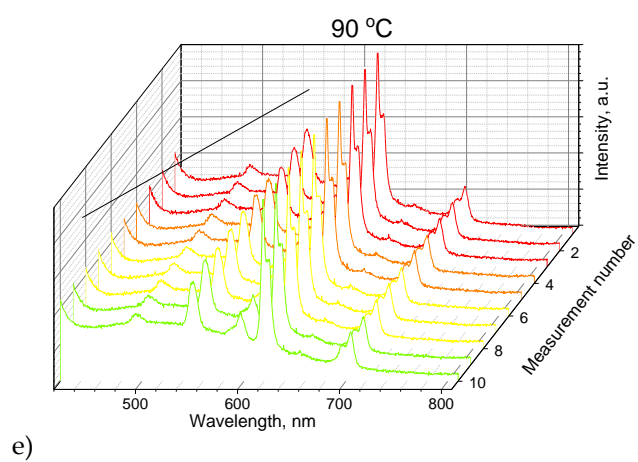
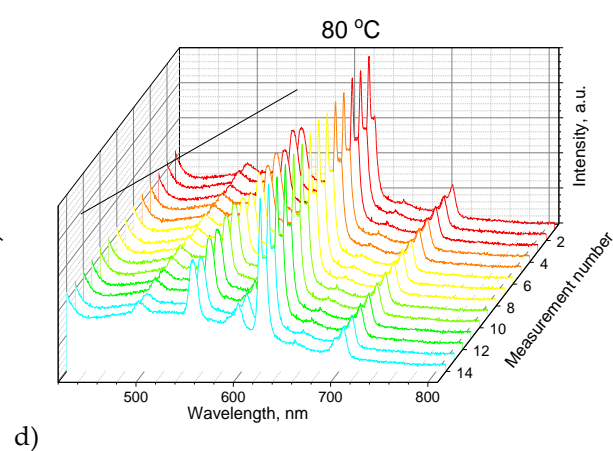
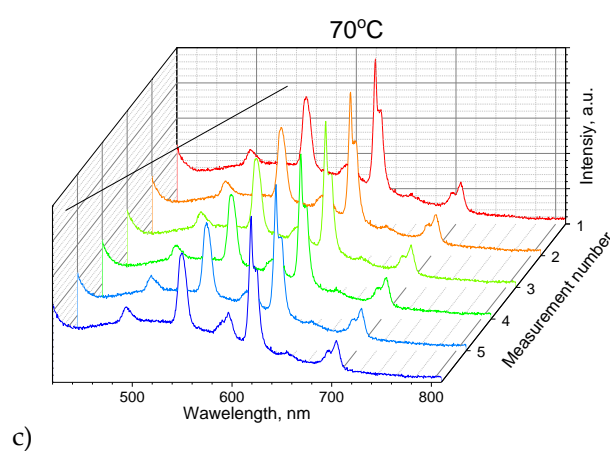
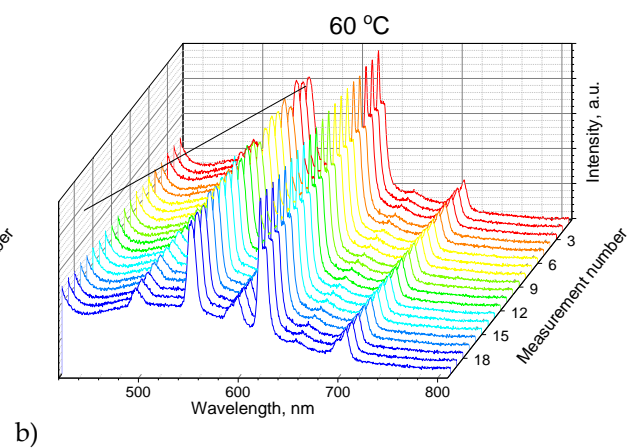
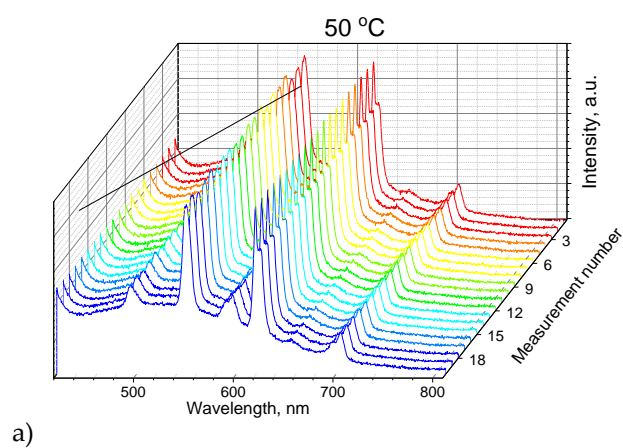
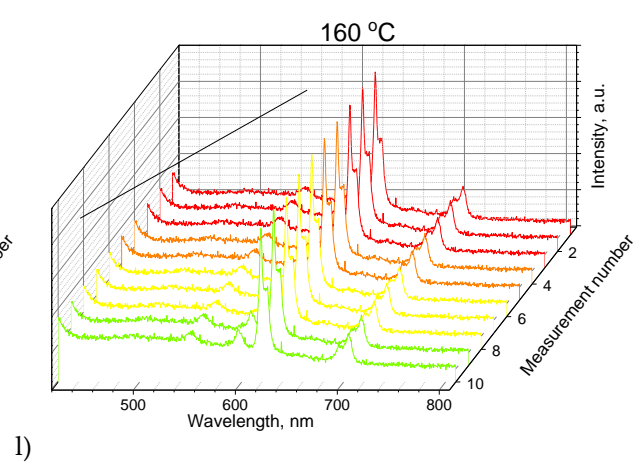
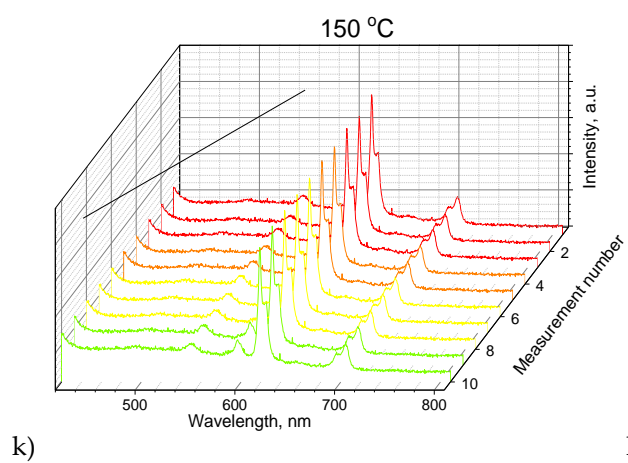
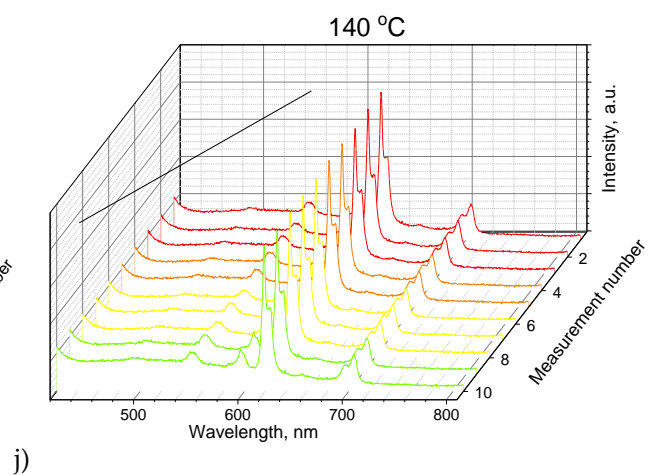
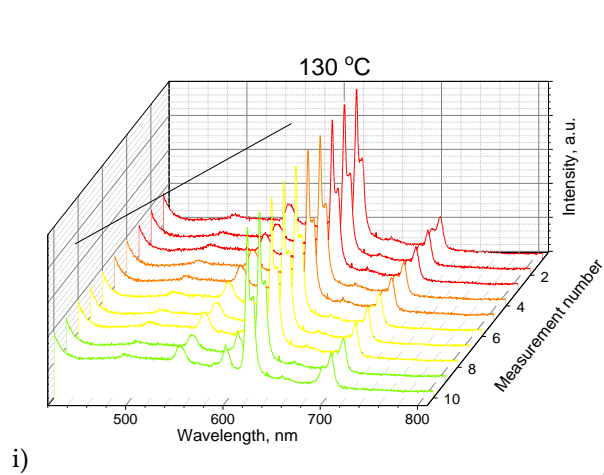
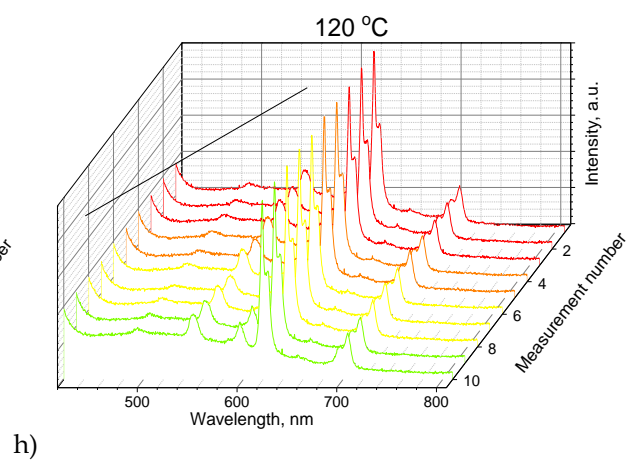
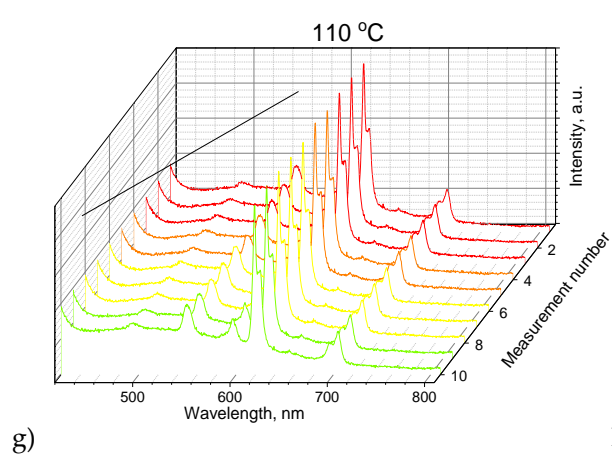


Figure S9 Reproducibility of LTPI1. Dependence of luminescence spectra (a, c, e, g, i) and LIR (b, d, f, h, j) on temperature when heated to 130 °C (a-b), 160 °C (c-d), 180 °C (e-f), 200 °C (g-h) and 220 °C (i-j). (λ_{ex} = 365 nm).

5. Uncertainty determination





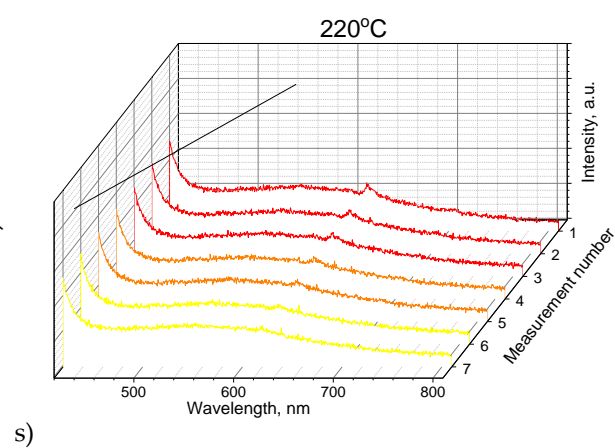
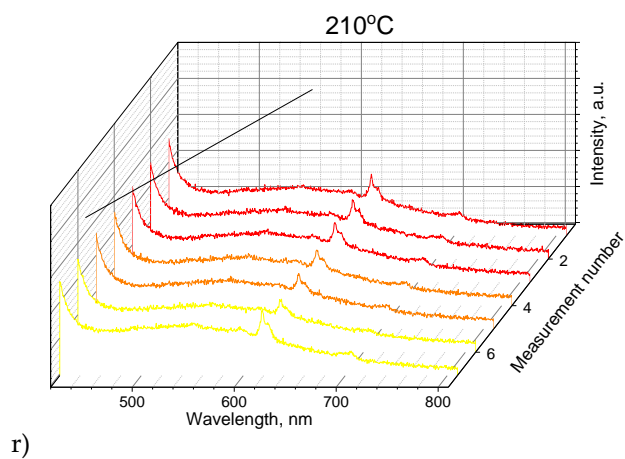
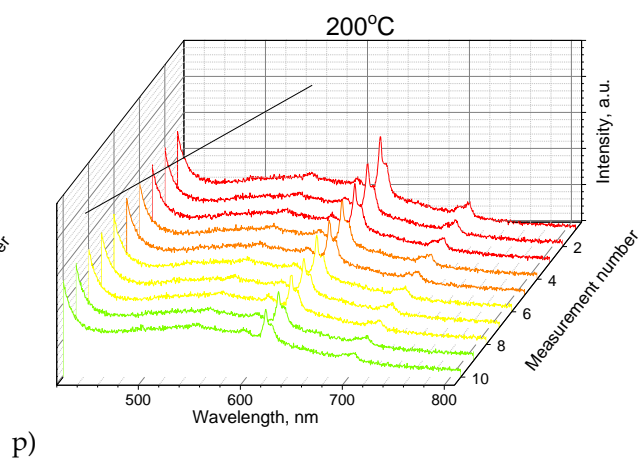
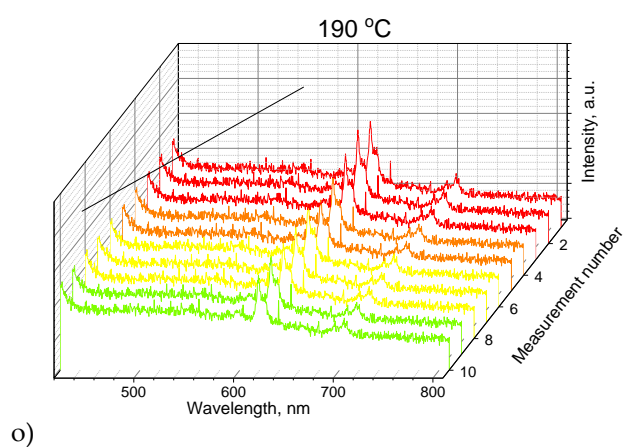
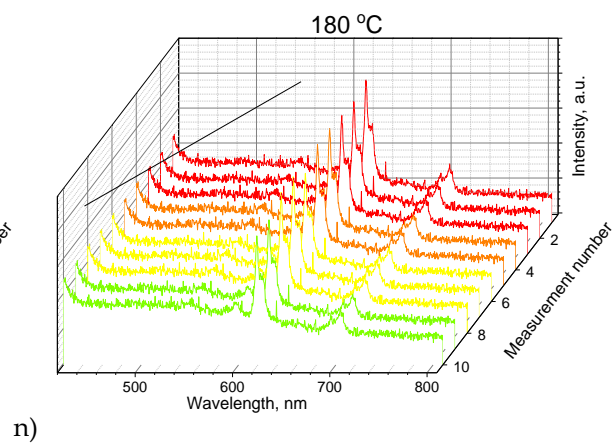
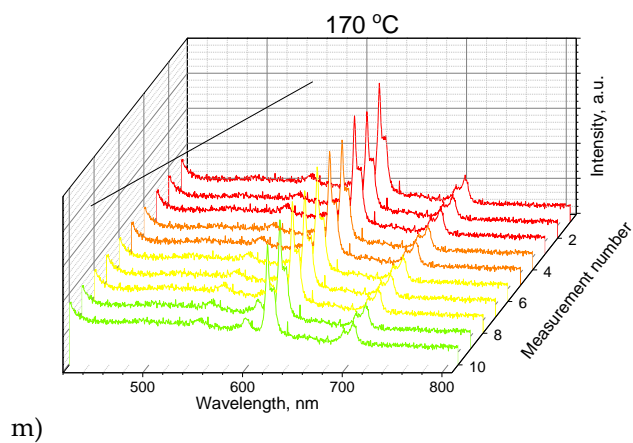
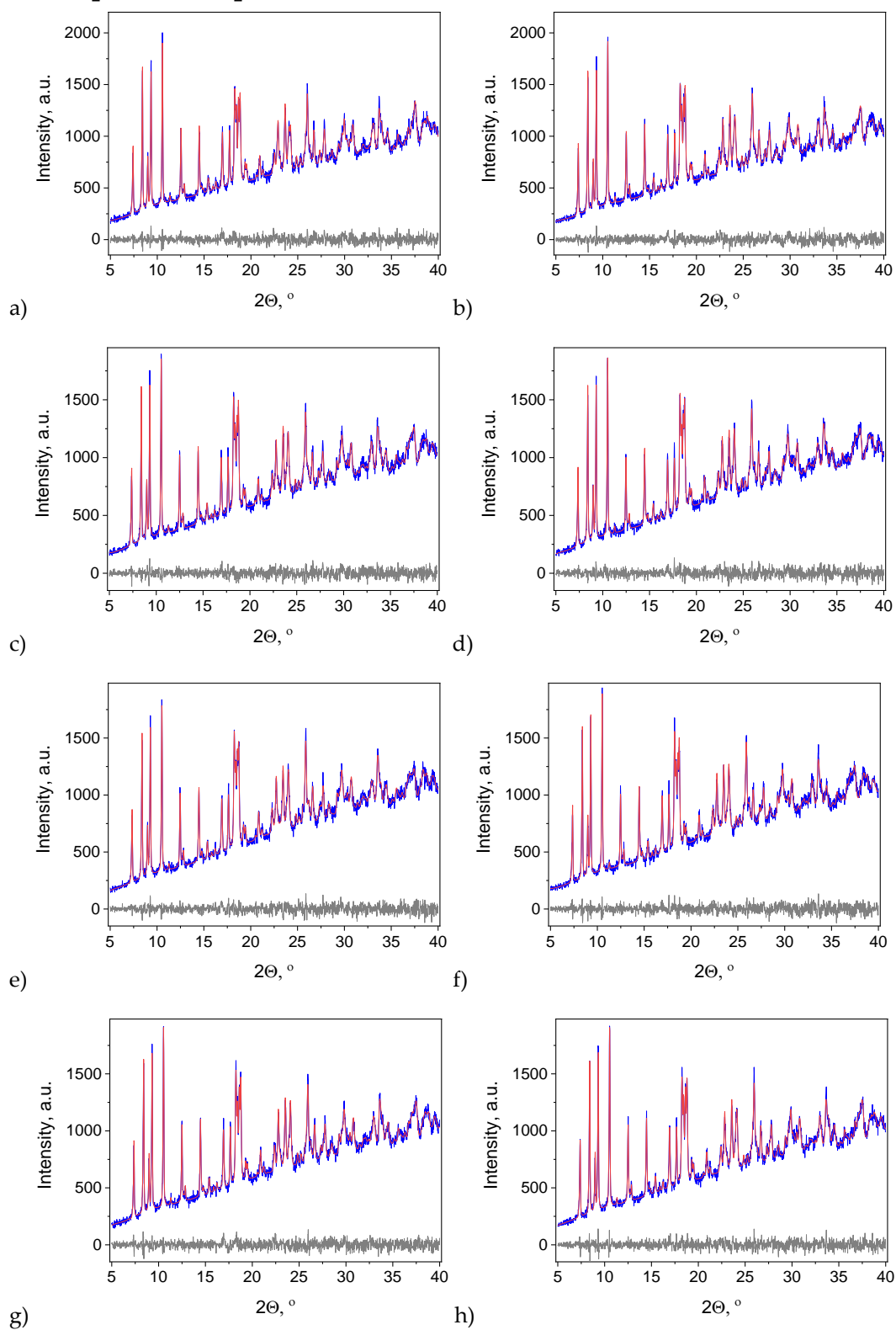
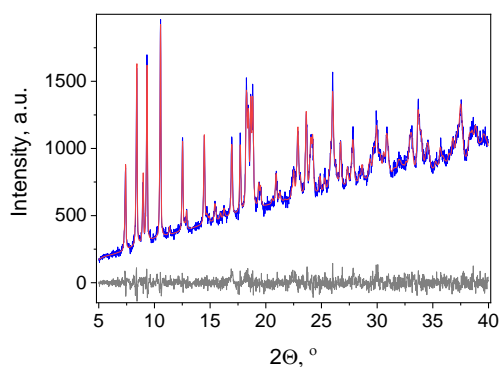


Figure S10 Luminescence spectra of LTPI1 measured several times successively in the range from 50 to 220 °C in steps of 10 degrees ($\lambda_{\text{ex}} = 365$ nm).

6. Temperature-dependent PXRD





i)

Figure S11 PXRd data for Eu(Bz)₃Phen at different temperatures: a) 30_start, b) 60_heat, c) 80_heat, d) 100_heat, e) 120_heat, f) 100_cool, g) 80_cool, h) 60_cool, i) 30_finish. Experimental curve (blue), fitting curve (red), difference (grey).

Indexing:

30_start

R-Bragg	1.226
Cell Volume (Å ³)	1399.6 (4)
Lattice parameters	
a (Å)	10.8166 (18)
b (Å)	11.9294 (19)
c (Å)	12.448 (2)
alpha (°)	105.050 (5)
beta (°)	93.618 (6)
gamma (°)	113.295 (6)

60_heat

R-Bragg	1.263
Cell Volume (Å ³)	1406.7 (3)
Lattice parameters	
a (Å)	10.8247 (14)
b (Å)	11.9465 (17)
c (Å)	12.4921 (17)
alpha (°)	105.086 (5)
beta (°)	93.569 (7)
gamma (°)	113.368 (6)

80_heat

R-Bragg	1.269
Cell Volume (Å ³)	1411.0 (5)
Lattice parameters	
a (Å)	10.831 (2)
b (Å)	11.956 (2)
c (Å)	12.518 (2)
alpha (°)	105.097 (5)
beta (°)	93.540 (7)
gamma (°)	113.411 (6)

100_heat

R-Bragg	1.055
Cell Volume (Å ³)	1416.0 (4)
Lattice parameters	
a (Å)	10.8350 (18)
b (Å)	11.971 (2)
c (Å)	12.548 (2)
alpha (°)	105.120 (6)
beta (°)	93.501 (7)
gamma (°)	113.470 (7)

120_heat

R-Bragg	1.071
Cell Volume (\AA^3)	1420.3 (5)
Lattice parameters	
a (\AA)	10.839 (2)
b (\AA)	11.981 (2)
c (\AA)	12.577 (2)
alpha ($^\circ$)	105.137 (6)
beta ($^\circ$)	93.461 (7)
gamma ($^\circ$)	113.528 (6)

100_cool

R-Bragg	0.917
Cell Volume (\AA^3)	1416.6 (5)
Lattice parameters	
a (\AA)	10.837 (2)
b (\AA)	11.972 (2)
c (\AA)	12.550 (2)
alpha ($^\circ$)	105.116 (5)
beta ($^\circ$)	93.514 (6)
gamma ($^\circ$)	113.457 (6)

80_cool

R-Bragg	1.136
Cell Volume (\AA^3)	1413.0 (4)
Lattice parameters	
a (\AA)	10.8333 (19)
b (\AA)	11.965 (2)
c (\AA)	12.526 (2)
alpha ($^\circ$)	105.101 (5)
beta ($^\circ$)	93.547 (6)
gamma ($^\circ$)	113.430 (6)

60_cool

R-Bragg	1.060
Cell Volume (\AA^3)	1408.7 (4)
Lattice parameters	
a (\AA)	10.8299 (17)
b (\AA)	11.9534 (18)
c (\AA)	12.498 (2)
alpha ($^\circ$)	105.086 (5)
beta ($^\circ$)	93.571 (6)
gamma ($^\circ$)	113.370 (6)

30_finish

R-Bragg	1.246
Cell Mass	2689.308
Cell Volume (\AA^3)	1402.2 (5)
Lattice parameters	
a (\AA)	10.823 (2)
b (\AA)	11.936 (2)
c (\AA)	12.458 (2)
alpha ($^\circ$)	105.051 (5)
beta ($^\circ$)	93.637 (6)
gamma ($^\circ$)	113.299 (6)