



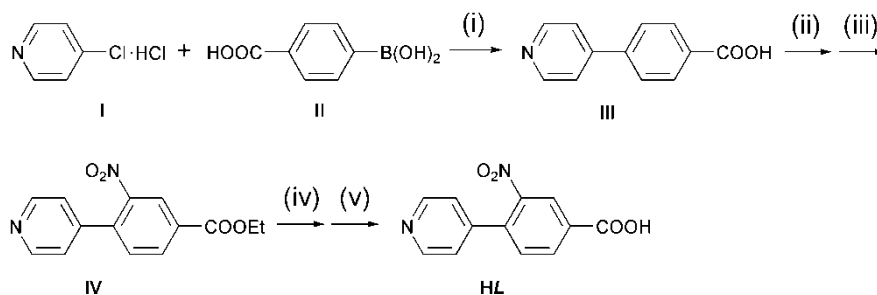
STRUCTURAL  
CHEMISTRY

**Volume 74 (2018)**

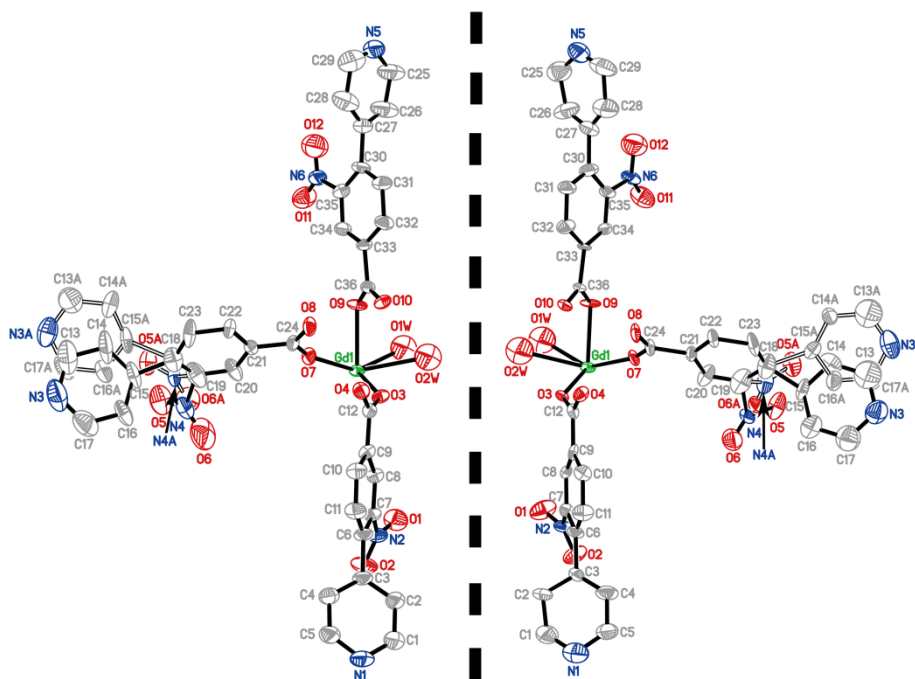
**Supporting information for article:**

**Unprecedented three-dimensional hydrogen-bonded hex  
topological chiral lanthanide–organic frameworks built from an  
achiral ligand**

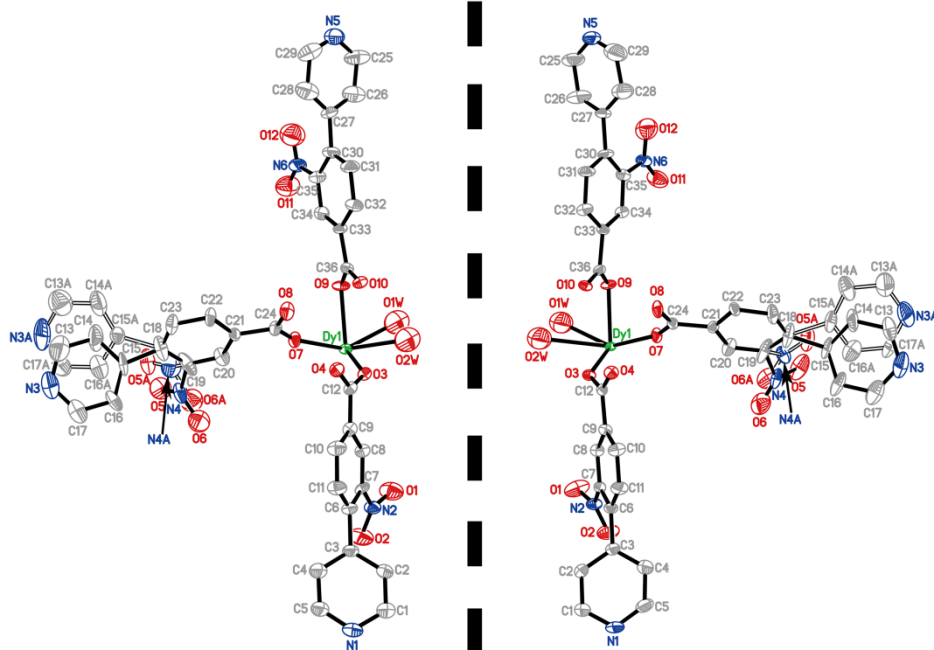
**Tao Qin, Zhe Feng, Jie Yang, Xuan Shen and Dunru Zhu**



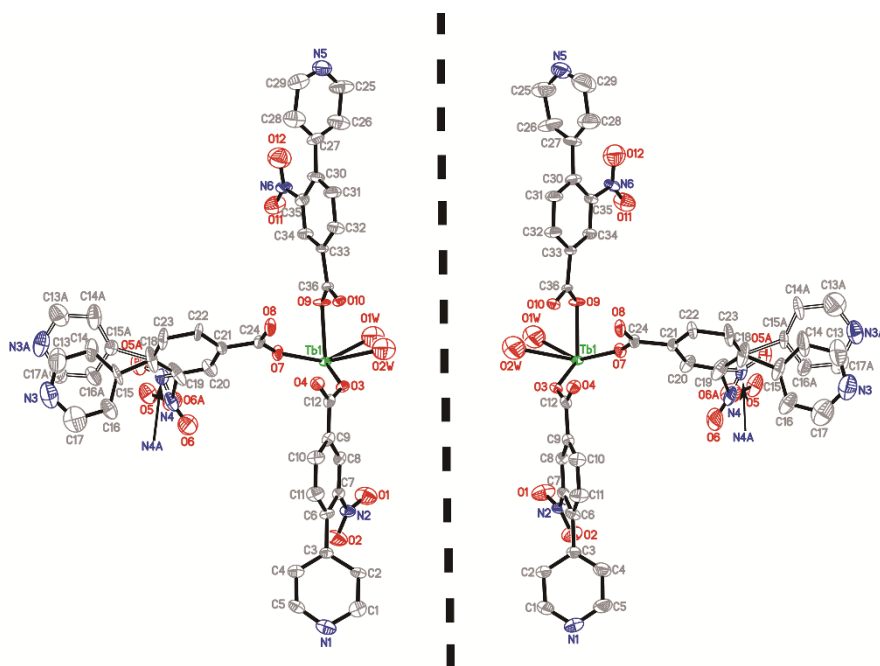
**Scheme S1** Synthesis of 3-nitro-4-(4'-pyridyl)benzoic acid (HL): (i) Pd(PPh<sub>3</sub>)<sub>4</sub>, K<sub>2</sub>CO<sub>3</sub>, Ar atmosphere, 100 °C, 24 h, (ii) H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>, 80 °C, 2 h, (iii) EtOH, H<sup>+</sup>, 80 °C, 24 h, (iv) NaOH, EtOH, 60 °C, 4 h, (v) H<sup>+</sup>.



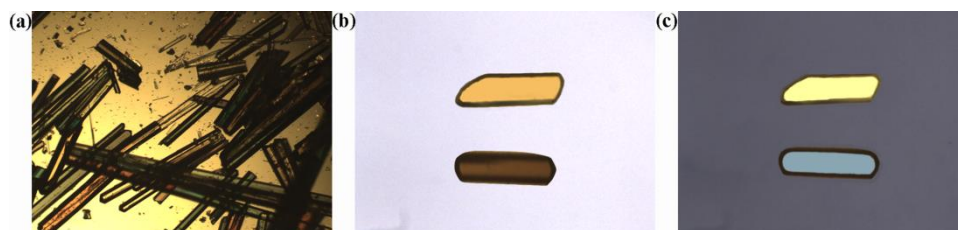
**Figure S1** ORTEP drawings (at 30% probability) of the asymmetric units for *L*-(2) (left) and *D*-(2) (right). Hydrogen atoms are omitted for clarity.



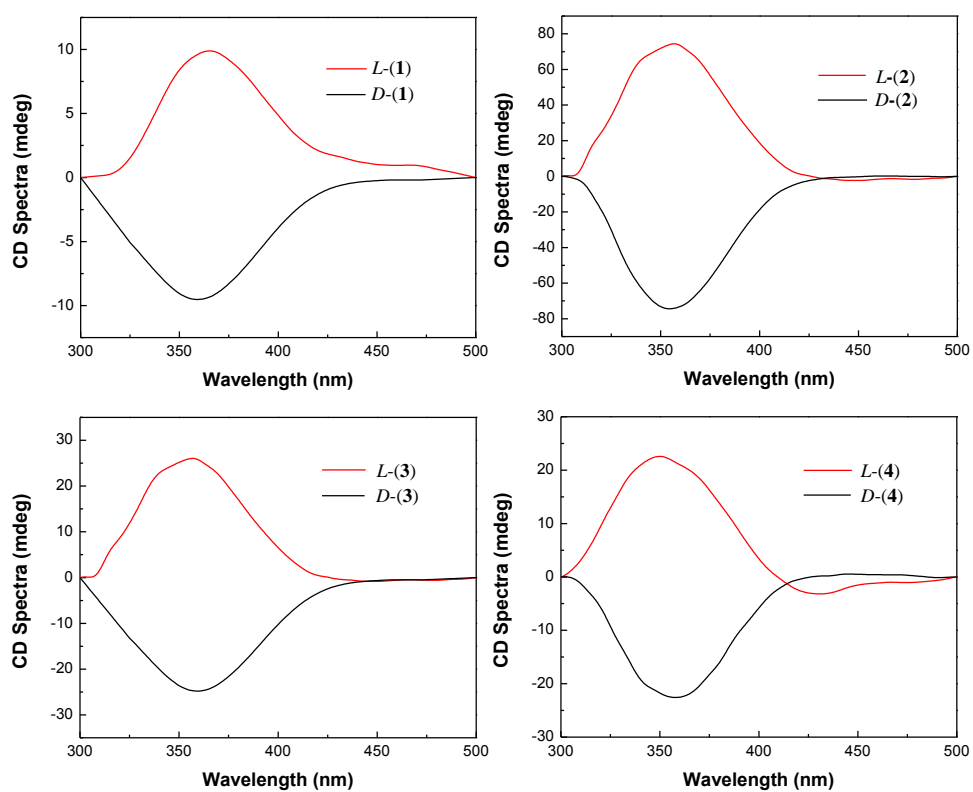
**Figure S2** ORTEP drawings (at 30% probability) of the asymmetric units for *L*-(3) (left) and *D*-(3) (right). Hydrogen atoms are omitted for clarity.



**Figure S3** ORTEP drawings (at 30% probability) of the asymmetric units for *L*-(4) (left) and *D*-(4) (right). Hydrogen atoms are omitted for clarity.



**Figure S4** Polarizing microscope images of **(1)**: (a) **(1)** under the bright field. (b) Dark crystal for *L*-**(1)** and light crystal for *D*-**(1)** under the bright field. (c) Pale blue crystal for *L*-**(1)** and the light yellow crystal for *D*-**(1)** under the dark field.



**Figure S5** CD spectra of **(1-4)**.

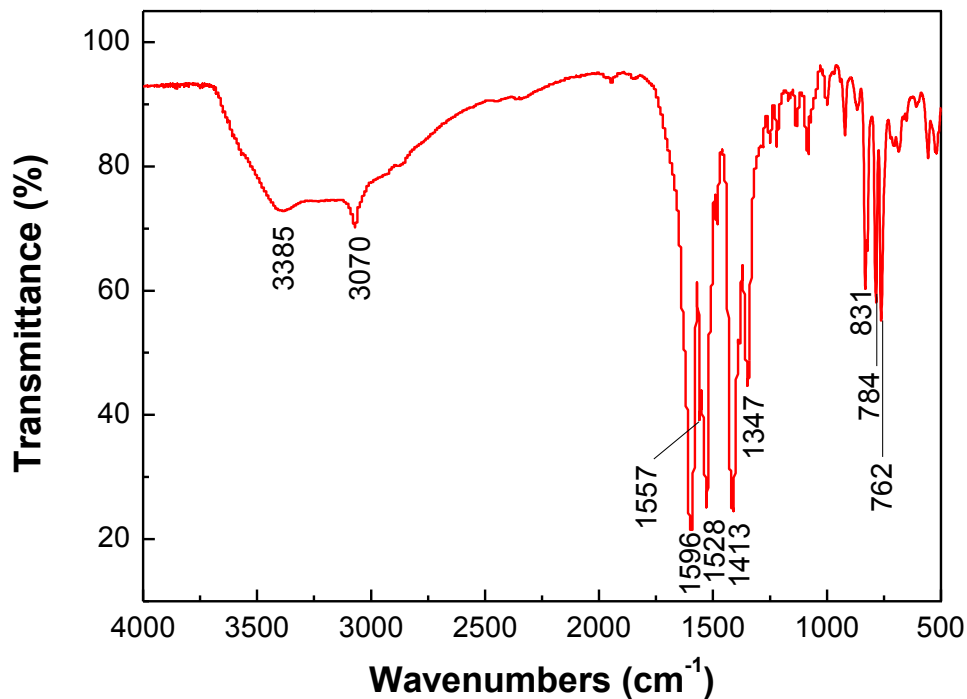


Figure S6 IR spectrum of (1).

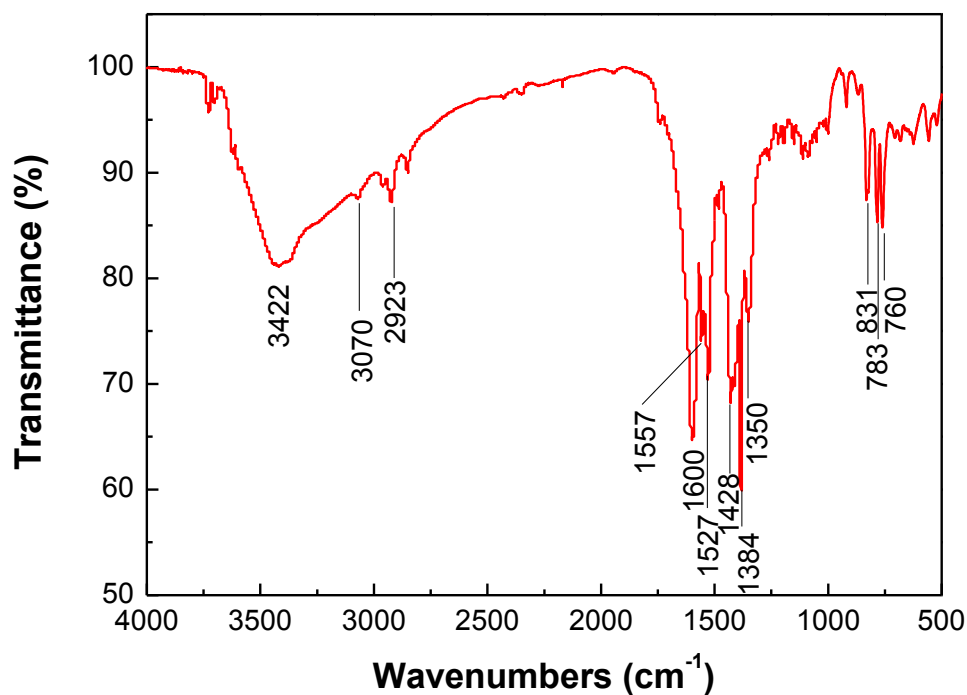


Figure S7 IR spectrum of (2).

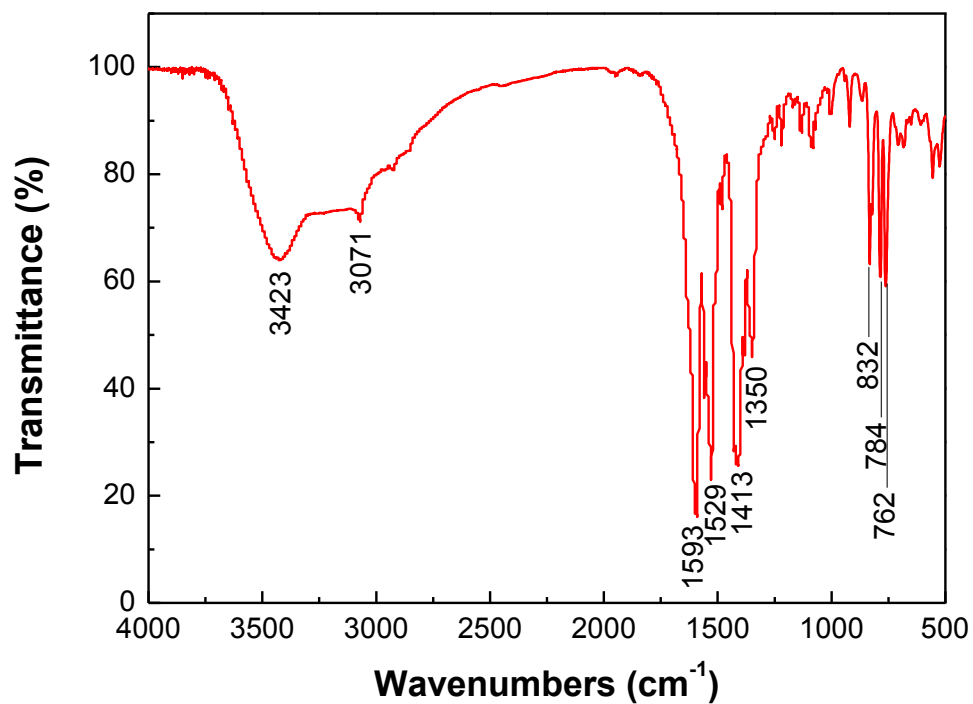


Figure S8 IR spectrum of (3).

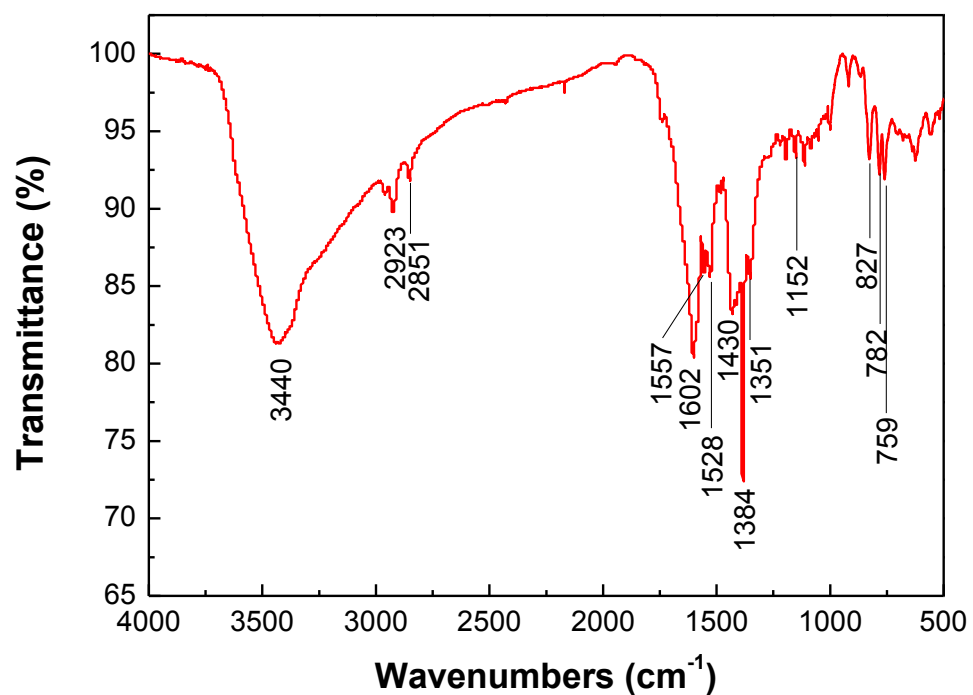
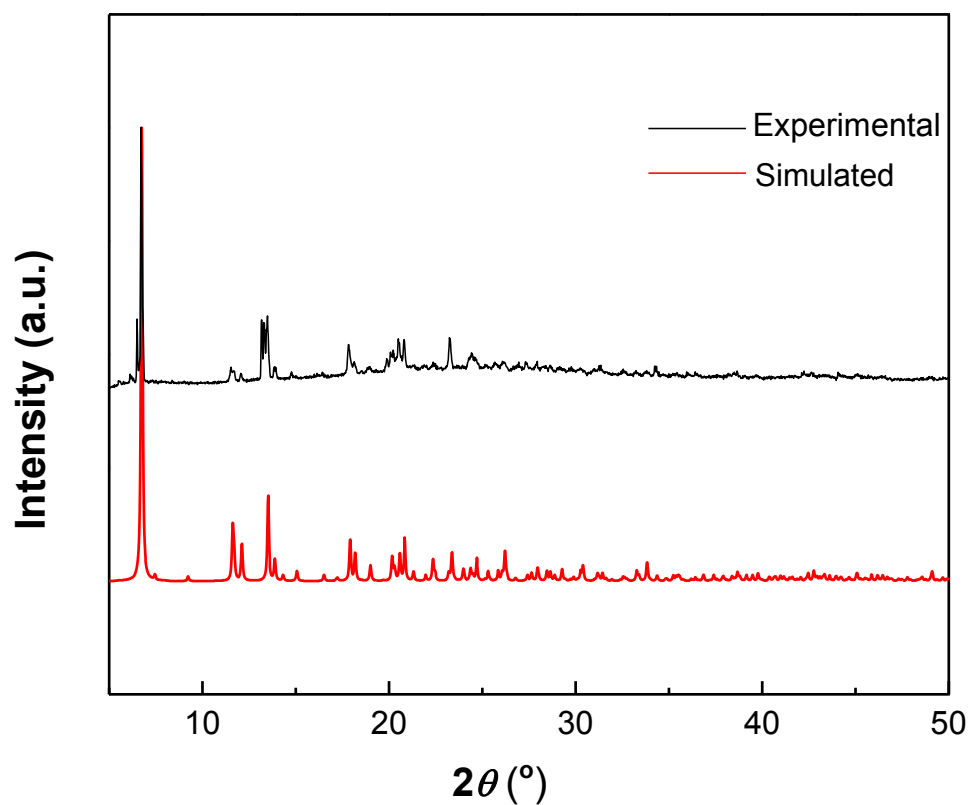
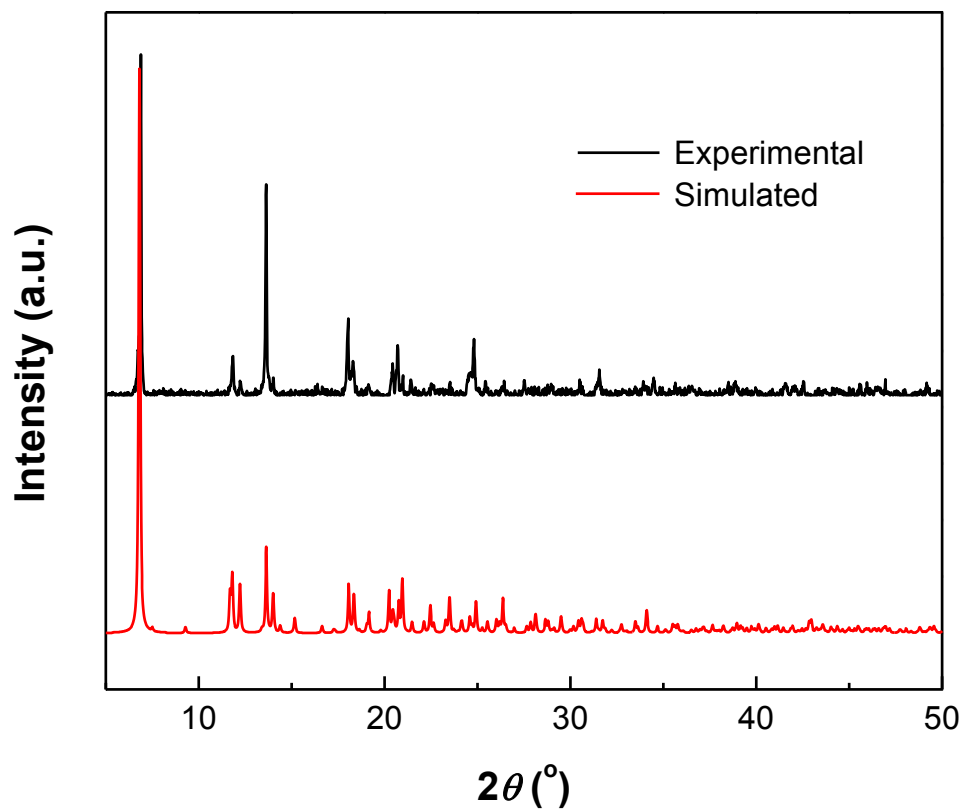


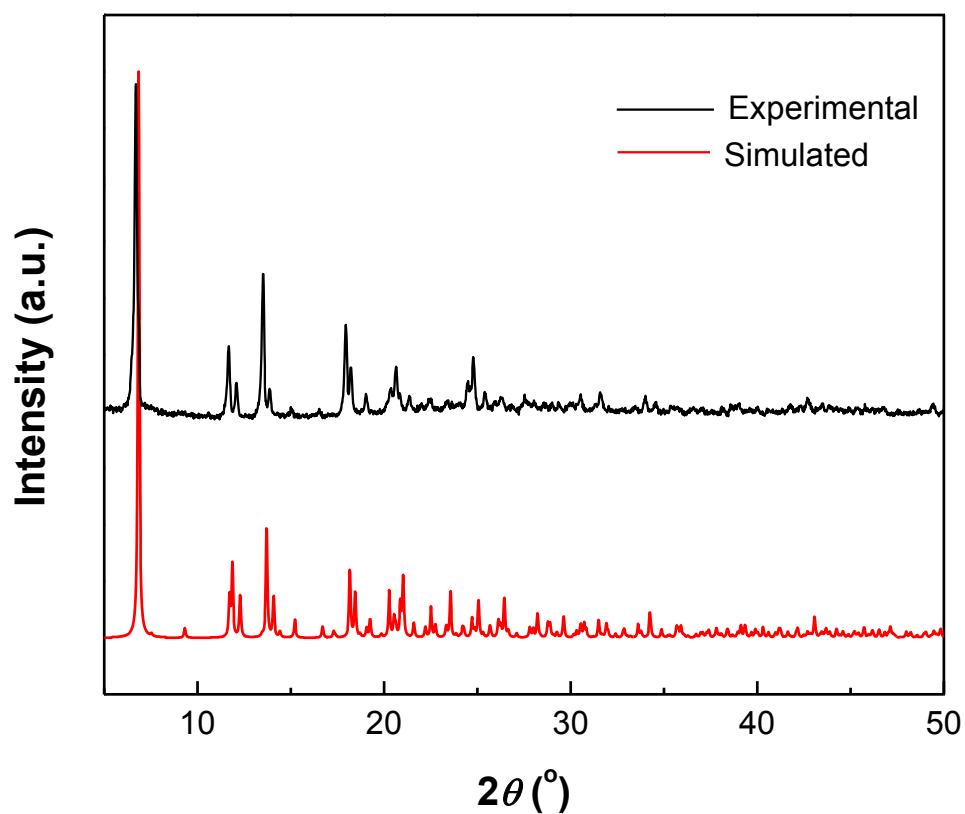
Figure S9 IR spectrum of (4).



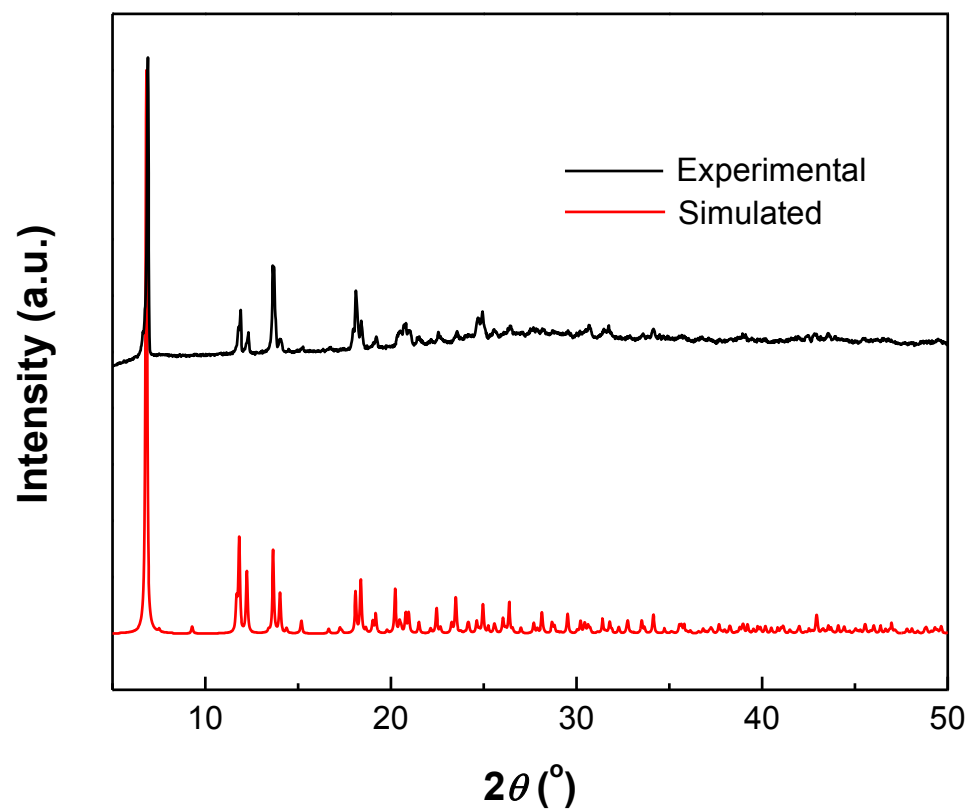
**Figure S10** Experimental and simulated powder X-ray diffraction patterns of (1).



**Figure S11** Experimental and simulated powder X-ray diffraction patterns of (2).

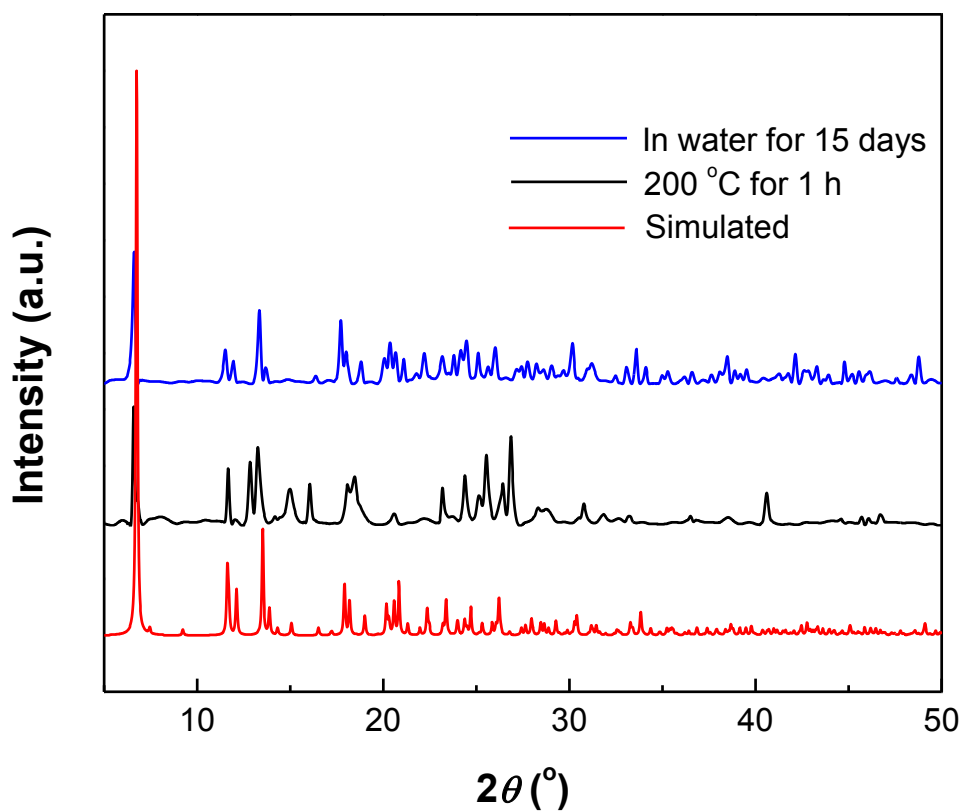


**Figure S12** Experimental and simulated powder X-ray diffraction patterns of (3).

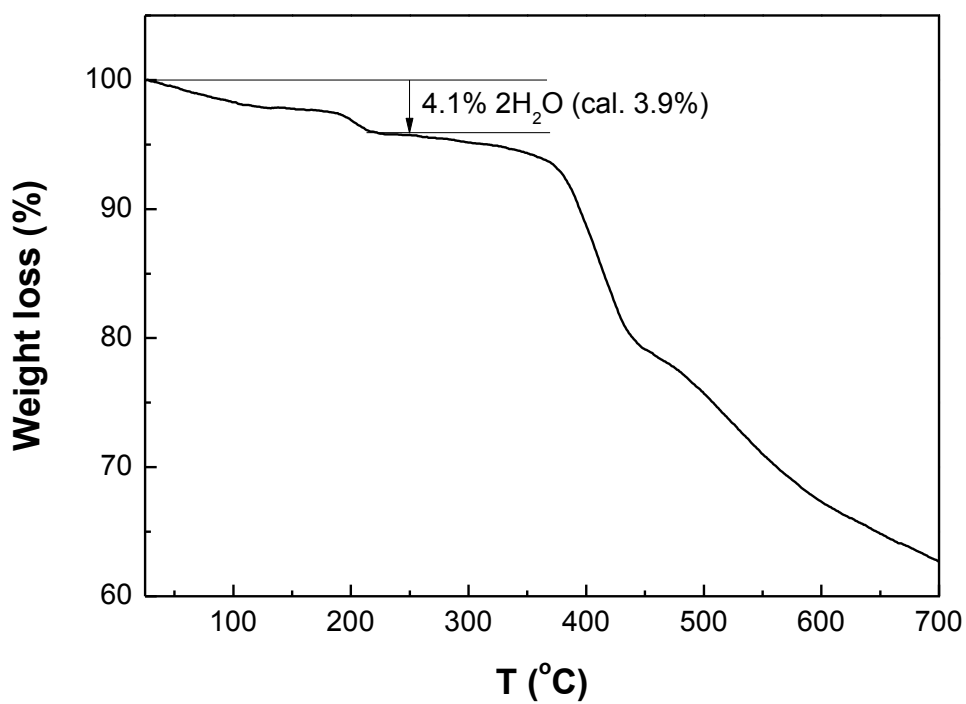


**Figure S13** Experimental and simulated powder X-ray diffraction patterns of (4).

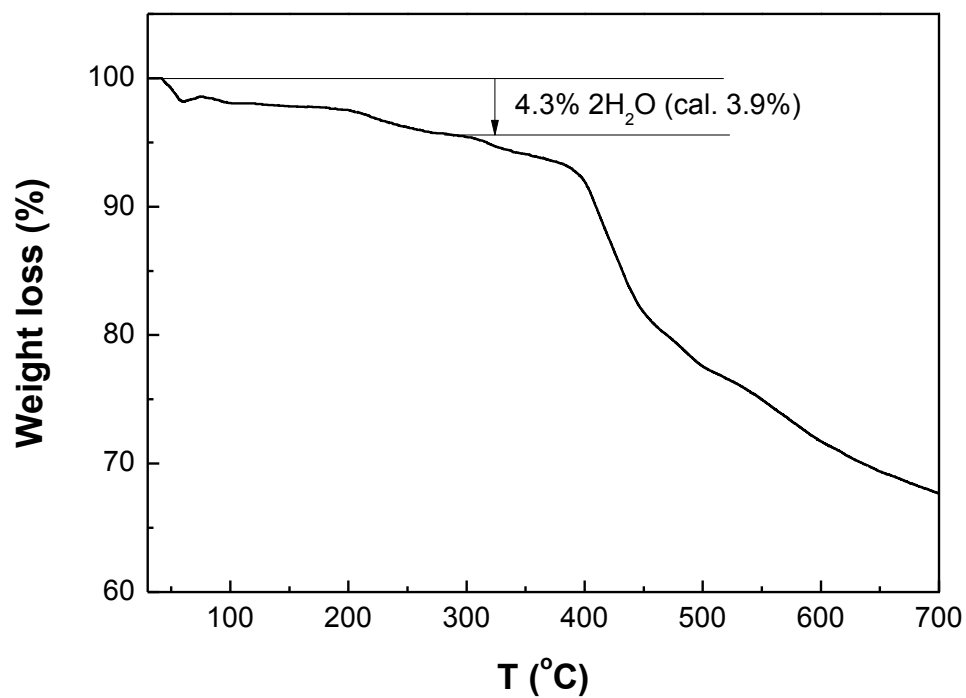




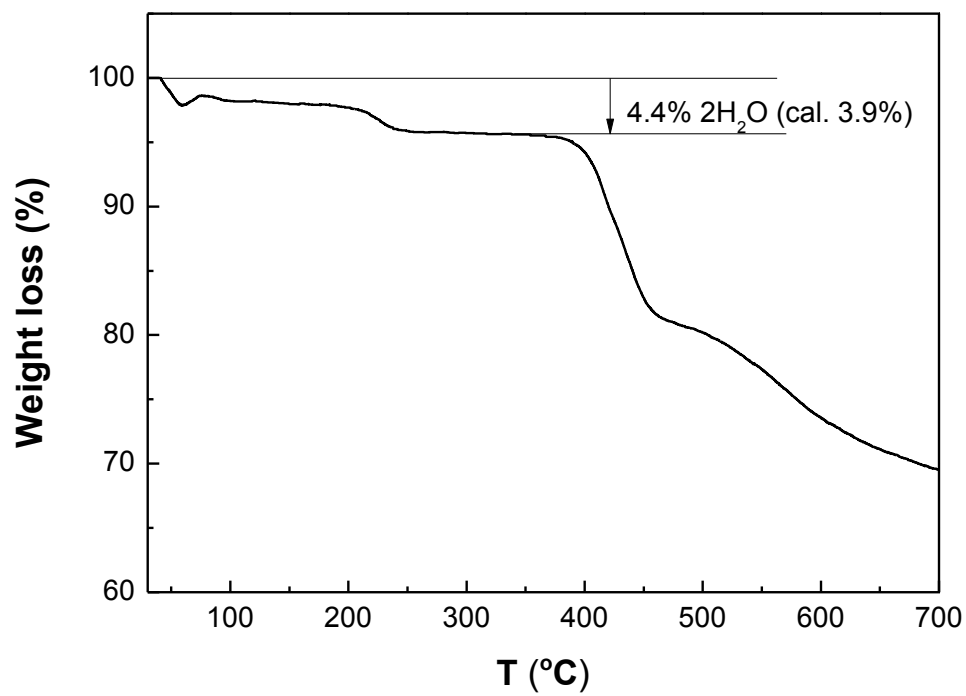
**Figure S14** PXRD patterns for water-treated and heated-treated samples of (1).



**Figure S15** TGA curve for (1).



**Figure S16** TGA curve for (2).



**Figure S17** TGA curve for (3).

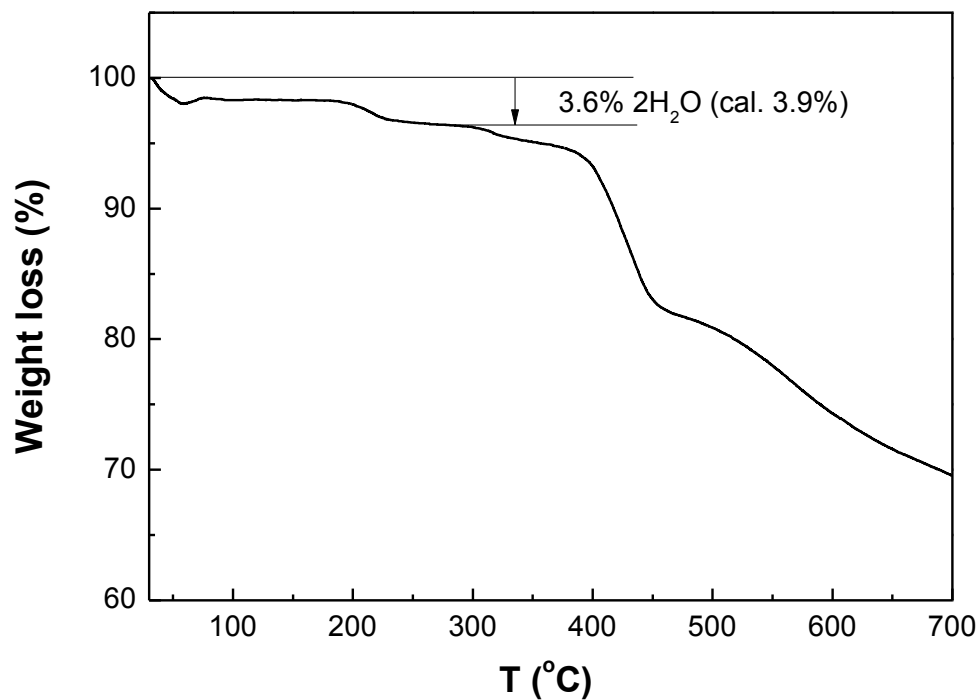


Figure S18 TGA curve for (4).

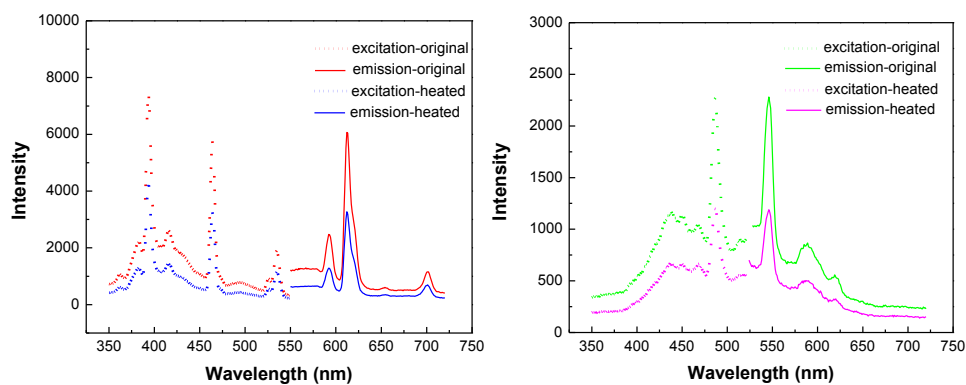
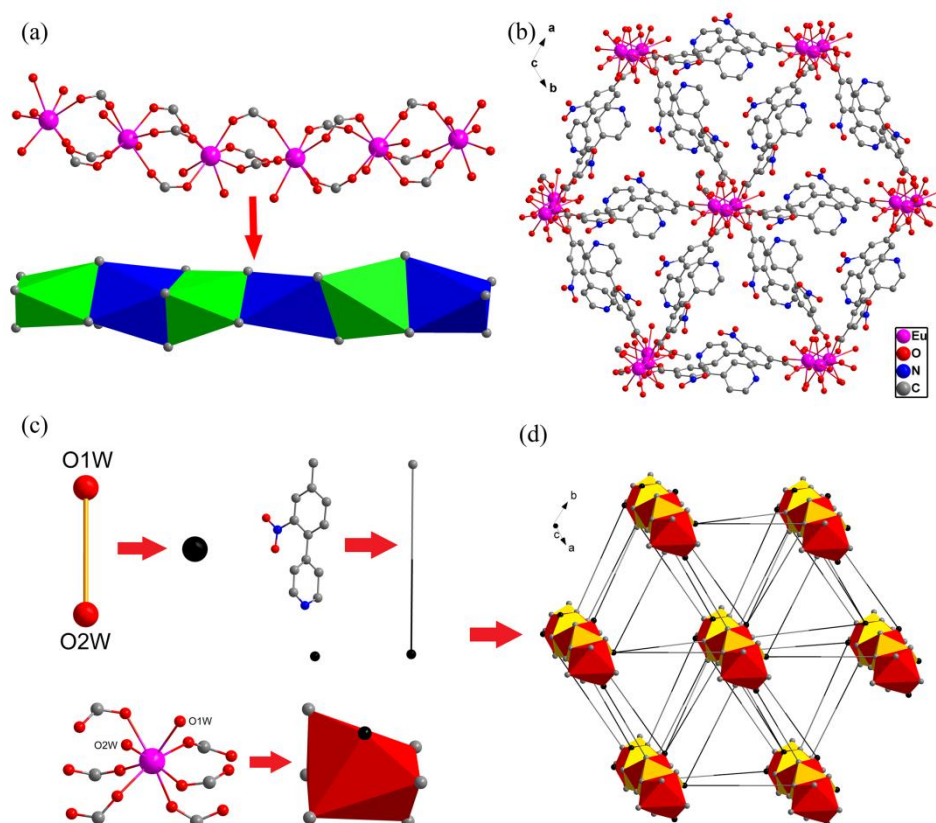


Figure S19 The photoluminescence spectra of (1) (left) and (4) (right).



**Figure S20** Structures of *L*-(1): (a) Ball-and-stick representation of 1D chain, and rod 1D chain with Eu shown as polyhedra. (b) Ball-and-stick representation of packing view along *c* axis. (c) Simplification of water molecules as a dot, ligand as a line, and 1D chain with Eu shown as polyhedra. (d) View of simplified framework with inorganic 1D helical chain linked together *via* pyridyl benzoic acid and water.

**Table S1** Selected bond lengths (Å) for (1-4).

<i>L</i> -(1)		<i>D</i> -(1)	
Eu1-O3	2.3218(15)	Eu1-O3	2.319(2)
Eu1-O7	2.3308(19)	Eu1-O7	2.305(2)
Eu1-O10 <sup>i</sup>	2.3447(14)	Eu1-O10 <sup>ii</sup>	2.329(2)
Eu1-O8 <sup>i</sup>	2.3876(19)	Eu1-O8 <sup>ii</sup>	2.378(2)
Eu1-O4 <sup>i</sup>	2.4053(15)	Eu1-O4 <sup>ii</sup>	2.377(2)
Eu1-O9	2.4305(14)	Eu1-O9	2.432(2)
Eu1-O1W	2.4518(19)	Eu1-O1W	2.347(3)
Eu1-O2W	2.562(3)	Eu1-O2W	2.668(4)
Eu1...Eu1 <sup>i</sup>	4.7568(7)	Eu1...Eu1 <sup>ii</sup>	4.7334(28)
<i>L</i> -(2)		<i>D</i> -(2)	

Gd1-O3	2.3113(15)	Gd1-O3	2.347(3)
Gd1-O7	2.3037(19)	Gd1-O7	2.270(3)
Gd1-O10 <sup>iii</sup>	2.3109(19)	Gd1-O10 <sup>ii</sup>	2.288(3)
Gd1-O8 <sup>iii</sup>	2.3620(18)	Gd1-O8 <sup>ii</sup>	2.361(3)
Gd1-O4 <sup>iii</sup>	2.389(2)	Gd1-O4 <sup>ii</sup>	2.374(4)
Gd1-O9	2.4233(18)	Gd1-O9	2.440(4)
Gd1-O1W	2.339(4)	Gd1-O1W	2.346(3)
Gd1-O2W	2.679(4)	Gd1-O2W	2.635(4)
Gd1...Gd1 <sup>iii</sup>	4.7423(6)	Gd1...Gd1 <sup>ii</sup>	4.7429(8)
<b>L-(3)</b>		<b>D-(3)</b>	
Dy1-O3	2.2950(18)	Dy1-O3	2.2912(19)
Dy1-O7	2.274(2)	Dy1-O7	2.282(2)
Dy1-O10 <sup>iii</sup>	2.261(2)	Dy1-O10 <sup>iv</sup>	2.2587(19)
Dy1-O8 <sup>iii</sup>	2.321(2)	Dy1-O8 <sup>iv</sup>	2.320(3)
Dy1-O4 <sup>iii</sup>	2.362(2)	Dy1-O4 <sup>iv</sup>	2.361(2)
Dy1-O9	2.394(2)	Dy1-O9	2.3961(19)
Dy1-O1W	2.332(5)	Dy1-O1W	2.345(6)
Dy1-O2W	2.648(4)	Dy1-O2W	2.782(4)
Dy1...Dy1 <sup>iii</sup>	4.7340(25)	Dy1...Dy1 <sup>iv</sup>	4.7388(6)
<b>L-(4)</b>		<b>D-(4)</b>	
Tb1-O3	2.310(2)	Tb1-O3	2.3068(19)
Tb1-O7	2.285(2)	Tb1-O7	2.287(3)
Tb1-O10 <sup>iii</sup>	2.277(3)	Tb1-O10 <sup>iv</sup>	2.287(2)
Tb1-O8 <sup>iii</sup>	2.343(2)	Tb1-O8 <sup>iv</sup>	2.346(3)
Tb1-O4 <sup>iii</sup>	2.363(3)	Tb1-O4 <sup>iv</sup>	2.363(2)
Tb1-O9	2.405(2)	Tb1-O9	2.408(2)
Tb1-O1W	2.335(5)	Tb1-O1W	2.337(6)
Tb1-O2W	2.633(4)	Tb1-O2W	2.725(5)
Tb1...Tb1 <sup>iii</sup>	4.7440(7)	Tb1...Tb1 <sup>iv</sup>	4.7451(9)

Symmetry code(s): (i)  $x-y, x-1, z-1/6$ ; (ii)  $y, y-x, z-1/6$ ; (iii)  $y, y-x, 1/6+z$ ; (iv)  $x-y, x, 1/6+z$ .

**Table S2** Selected bond angles ( $^{\circ}$ ) for (**1-4**).

<b>L-(1)</b>		<b>D-(1)</b>	
O3-Eu1-O7	77.73(6)	O3-Eu1-O7	79.79(8)
O3-Eu1-O10 <sup>i</sup>	155.89(7)	O3-Eu1-O10 <sup>ii</sup>	160.49(5)
O7-Eu1-O10 <sup>i</sup>	87.28(6)	O7-Eu1-O10 <sup>ii</sup>	90.56(8)
O3-Eu1-O8 <sup>i</sup>	81.30(6)	O3-Eu1-O8 <sup>ii</sup>	83.62(7)
O7-Eu1-O8 <sup>i</sup>	74.75(6)	O7-Eu1-O8 <sup>ii</sup>	73.99(8)
O10 <sup>i</sup> -Eu1-O8 <sup>i</sup>	76.55(6)	O10 <sup>ii</sup> -Eu1-O8 <sup>ii</sup>	77.40(7)
O3-Eu1-O4 <sup>i</sup>	77.72(6)	O3-Eu1-O4 <sup>ii</sup>	76.70(8)
O7-Eu1-O4 <sup>i</sup>	143.77(6)	O7-Eu1-O4 <sup>ii</sup>	143.33(7)
O10 <sup>i</sup> -Eu1-O4 <sup>i</sup>	105.42(5)	O10 <sup>ii</sup> -Eu1-O4 <sup>ii</sup>	102.61(8)
O8 <sup>i</sup> -Eu1-O4 <sup>i</sup>	75.54(6)	O8 <sup>ii</sup> -Eu1-O4 <sup>ii</sup>	75.76(8)
O3-Eu1-O9	108.99(5)	O3-Eu1-O9	108.82(8)
O7-Eu1-O9	72.12(5)	O7-Eu1-O9	73.20(7)
O10 <sup>i</sup> -Eu1-O9	83.62(6)	O10 <sup>ii</sup> -Eu1-O9	84.11(7)
O8 <sup>i</sup> -Eu1-O9	141.93(6)	O8 <sup>ii</sup> -Eu1-O9	141.92(7)
O4 <sup>i</sup> -Eu1-O9	141.80(7)	O4 <sup>ii</sup> -Eu1-O9	141.41(6)

O3-Eu1-O1W	126.76(7)	O3-Eu1-O1W	113.61(8)
O7-Eu1-O1W	144.81(5)	O7-Eu1-O1W	145.94(9)
O10 <sup>i</sup> -Eu1-O1W	75.60(7)	O10 <sup>ii</sup> -Eu1-O1W	83.76(9)
O8 <sup>i</sup> -Eu1-O1W	128.35(7)	O8 <sup>ii</sup> -Eu1-O1W	136.18(10)
O4 <sup>i</sup> -Eu1-O1W	71.25(7)	O4 <sup>ii</sup> -Eu1-O1W	70.29(9)
O9-Eu1-O1W	75.55(6)	O9-Eu1-O1W	72.82(9)
O3-Eu1-O2W	65.08(7)	O3-Eu1-O2W	64.82(9)
O7-Eu1-O2W	118.18(7)	O7-Eu1-O2W	120.00(11)
O10 <sup>i</sup> -Eu1-O2W	139.01(6)	O10 <sup>ii</sup> -Eu1-O2W	134.19(10)
O8 <sup>i</sup> -Eu1-O2W	138.18(5)	O8 <sup>ii</sup> -Eu1-O2W	140.12(11)
O4 <sup>i</sup> -Eu1-O2W	73.65(7)	O4 <sup>ii</sup> -Eu1-O2W	73.78(11)
O9-Eu1-O2W	75.69(7)	O9-Eu1-O2W	74.68(10)
O1W-Eu1-O2W	65.22(7)	O1W-Eu1-O2W	51.46(11)
<b>L-(2)</b>		<b>D-(2)</b>	
O3-Gd1-O7	80.52(6)	O3-Gd1-O7	80.98(12)
O3-Gd1-O10 <sup>iii</sup>	161.73(7)	O3-Gd1-O10 <sup>ii</sup>	162.28(9)
O7-Gd1-O10 <sup>iii</sup>	90.81(6)	O7-Gd1-O10 <sup>ii</sup>	93.18(13)
O3-Gd1-O8 <sup>iii</sup>	84.74(8)	O3-Gd1-O8 <sup>ii</sup>	84.23(13)
O7-Gd1-O8 <sup>iii</sup>	73.62(8)	O7-Gd1-O8 <sup>ii</sup>	73.97(14)
O10 <sup>iii</sup> -Gd1-O8 <sup>iii</sup>	77.37(8)	O10 <sup>ii</sup> -Gd1-O8 <sup>ii</sup>	78.07(13)
O3-Gd1-O4 <sup>iii</sup>	76.82(7)	O3-Gd1-O4 <sup>ii</sup>	76.11(11)
O7-Gd1-O4 <sup>iii</sup>	143.39(7)	O7-Gd1-O4 <sup>ii</sup>	144.19(13)
O10 <sup>iii</sup> -Gd1-O4 <sup>iii</sup>	102.01(7)	O10 <sup>ii</sup> -Gd1-O4 <sup>ii</sup>	100.35(13)
O8 <sup>iii</sup> -Gd1-O4 <sup>iii</sup>	75.98(7)	O8 <sup>ii</sup> -Gd1-O4 <sup>ii</sup>	76.64(15)
O3-Gd1-O9	107.92(6)	O3-Gd1-O9	108.45(12)
O7-Gd1-O9	73.34(7)	O7-Gd1-O9	72.80(12)
O10 <sup>iii</sup> -Gd1-O9	84.58(6)	O10 <sup>ii</sup> -Gd1-O9	85.43(11)
O8 <sup>iii</sup> -Gd1-O9	141.85(7)	O8 <sup>ii</sup> -Gd1-O9	141.78(14)
O4 <sup>iii</sup> -Gd1-O9	141.28(6)	O4 <sup>ii</sup> -Gd1-O9	140.79(11)
O3-Gd1-O1W	111.80(8)	O3-Gd1-O1W	106.84(12)
O7-Gd1-O1W	147.21(10)	O7-Gd1-O1W	144.66(15)
O10 <sup>iii</sup> -Gd1-O1W	84.09(8)	O10 <sup>ii</sup> -Gd1-O1W	87.63(14)
O8 <sup>iii</sup> -Gd1-O1W	135.64(10)	O8 <sup>ii</sup> -Gd1-O1W	140.08(15)
O4 <sup>iii</sup> -Gd1-O1W	68.98(8)	O4 <sup>ii</sup> -Gd1-O1W	69.52(14)
O9-Gd1-O1W	73.94(9)	O9-Gd1-O1W	72.05(13)
O3-Gd1-O2W	60.11(9)	O3-Gd1-O2W	60.78(11)
O7-Gd1-O2W	116.30(9)	O7-Gd1-O2W	116.35(12)
O10 <sup>iii</sup> -Gd1-O2W	137.77(8)	O10 <sup>ii</sup> -Gd1-O2W	135.74(12)
O8 <sup>iii</sup> -Gd1-O2W	138.94(9)	O8 <sup>ii</sup> -Gd1-O2W	139.24(16)
O4 <sup>iii</sup> -Gd1-O2W	75.84(7)	O4 <sup>ii</sup> -Gd1-O2W	75.21(14)
O9-Gd1-O2W	74.23(7)	O9-Gd1-O2W	74.04(13)
O1W-Gd1-O2W	55.31(11)	O1W-Gd1-O2W	49.04(13)
<b>L-(3)</b>		<b>D-(3)</b>	
O3-Dy1-O7	81.02(7)	O3-Dy1-O7	81.17(8)
O3-Dy1-O10 <sup>iii</sup>	164.40(7)	O3-Dy1-O10 <sup>iv</sup>	164.81(8)
O7-Dy1-O10 <sup>iii</sup>	91.59(7)	O7-Dy1-O10 <sup>iv</sup>	92.12(8)
O3-Dy1-O8 <sup>iii</sup>	86.35(9)	O3-Dy1-O8 <sup>iv</sup>	86.64(8)
O7-Dy1-O8 <sup>iii</sup>	73.59(9)	O7-Dy1-O8 <sup>iv</sup>	73.05(8)
O10 <sup>iii</sup> -Dy1-O8 <sup>iii</sup>	78.35(9)	O10 <sup>iv</sup> -Dy1-O8 <sup>iv</sup>	78.36(9)

O3-Dy1-O4 <sup>iii</sup>	77.25(8)	O3-Dy1-O4 <sup>iv</sup>	77.00(8)
O7-Dy1-O4 <sup>iii</sup>	143.27(8)	O7-Dy1-O4 <sup>iv</sup>	143.07(8)
O10 <sup>iii</sup> -Dy1-O4 <sup>iii</sup>	101.65(8)	O10 <sup>iv</sup> -Dy1-O4 <sup>iv</sup>	101.35(7)
O8 <sup>iii</sup> -Dy1-O4 <sup>iii</sup>	75.79(8)	O8 <sup>iv</sup> -Dy1-O4 <sup>iv</sup>	76.25(9)
O3-Dy1-O9	106.62(7)	O3-Dy1-O9	106.05(7)
O7-Dy1-O9	73.24(9)	O7-Dy1-O9	73.42(8)
O10 <sup>iii</sup> -Dy1-O9	84.08(8)	O10 <sup>iv</sup> -Dy1-O9	84.79(8)
O8 <sup>iii</sup> -Dy1-O9	141.76(9)	O8 <sup>iv</sup> -Dy1-O9	141.63(9)
O4 <sup>iii</sup> -Dy1-O9	141.57(7)	O4 <sup>iv</sup> -Dy1-O9	141.39(9)
O3-Dy1-O1W	103.71(9)	O3-Dy1-O1W	103.52(14)
O7-Dy1-O1W	145.60(11)	O7-Dy1-O1W	145.12(13)
O10 <sup>iii</sup> -Dy1-O1W	90.17(8)	O10 <sup>iv</sup> -Dy1-O1W	89.79(14)
O8 <sup>iii</sup> -Dy1-O1W	140.07(11)	O8 <sup>iv</sup> -Dy1-O1W	141.04(13)
O4 <sup>iii</sup> -Dy1-O1W	69.25(9)	O4 <sup>iv</sup> -Dy1-O1W	69.88(14)
O9-Dy1-O1W	72.79(10)	O9-Dy1-O1W	72.08(13)
O3-Dy1-O2W	55.06(9)	O3-Dy1-O2W	54.82(8)
O7-Dy1-O2W	111.04(10)	O7-Dy1-O2W	109.47(11)
O10 <sup>iii</sup> -Dy1-O2W	140.43(9)	O10 <sup>iv</sup> -Dy1-O2W	140.26(9)
O8 <sup>iii</sup> -Dy1-O2W	138.03(10)	O8 <sup>iv</sup> -Dy1-O2W	139.02(8)
O4 <sup>iii</sup> -Dy1-O2W	79.65(8)	O4 <sup>iv</sup> -Dy1-O2W	81.35(11)
O9-Dy1-O2W	72.82(8)	O9-Dy1-O2W	70.87(10)
O1W-Dy1-O2W	52.78(11)	O1W-Dy1-O2W	53.46(14)
<b>L-(4)</b>		<b>D-(4)</b>	
O3-Tb1-O7	80.46(8)	O3-Tb1-O7	80.78(9)
O3-Tb1-O10 <sup>iv</sup>	163.67(8)	O3-Tb1-O10 <sup>iv</sup>	162.94(9)
O7-Tb1-O10 <sup>iv</sup>	92.49(8)	O7-Tb1-O10 <sup>iv</sup>	91.71(9)
O3-Tb1-O8 <sup>iv</sup>	85.87(11)	O3-Tb1-O8 <sup>iv</sup>	85.16(8)
O7-Tb1-O8 <sup>iv</sup>	73.48(10)	O7-Tb1-O8 <sup>iv</sup>	73.93(8)
O10 <sup>iv</sup> -Tb1-O8 <sup>iv</sup>	77.98(10)	O10 <sup>iv</sup> -Tb1-O8 <sup>iv</sup>	78.03(9)
O3-Tb1-O4 <sup>iv</sup>	77.03(8)	O3-Tb1-O4 <sup>iv</sup>	76.89(8)
O7-Tb1-O4 <sup>iv</sup>	143.39(9)	O7-Tb1-O4 <sup>iv</sup>	143.75(8)
O10 <sup>iv</sup> -Tb1-O4 <sup>iv</sup>	101.18(9)	O10 <sup>iv</sup> -Tb1-O4 <sup>iv</sup>	101.50(8)
O8 <sup>iv</sup> -Tb1-O4 <sup>iv</sup>	76.42(9)	O8 <sup>iv</sup> -Tb1-O4 <sup>iv</sup>	76.04(9)
O3-Tb1-O9	107.06(8)	O3-Tb1-O9	107.60(7)
O7-Tb1-O9	73.60(10)	O7-Tb1-O9	72.98(8)
O10 <sup>iv</sup> -Tb1-O9	84.72(8)	O10 <sup>iv</sup> -Tb1-O9	84.46(8)
O8 <sup>iv</sup> -Tb1-O9	141.85(10)	O8 <sup>iv</sup> -Tb1-O9	141.83(9)
O4 <sup>iv</sup> -Tb1-O9	140.85(8)	O4 <sup>iv</sup> -Tb1-O9	141.26(10)
O3-Tb1-O1W	105.40(10)	O3-Tb1-O1W	107.53(15)
O7-Tb1-O1W	145.59(13)	O7-Tb1-O1W	145.42(13)
O10 <sup>iv</sup> -Tb1-O1W	88.76(10)	O10 <sup>iv</sup> -Tb1-O1W	87.35(15)
O8 <sup>iv</sup> -Tb1-O1W	139.89(13)	O8 <sup>iv</sup> -Tb1-O1W	138.96(14)
O4 <sup>iv</sup> -Tb1-O1W	69.23(11)	O4 <sup>iv</sup> -Tb1-O1W	69.60(15)

O9-Tb1-O1W	72.28(12)	O9-Tb1-O1W	72.53(14)
O3-Tb1-O2W	58.97(11)	O3-Tb1-O2W	59.26(9)
O7-Tb1-O2W	114.81(11)	O7-Tb1-O2W	115.60(11)
	)		
O10 <sup>iv</sup> -Tb1-O2W	136.92(10)	O10 <sup>iv</sup> -Tb1-O2W	137.33(10)
	)		
O8 <sup>iv</sup> -Tb1-O2W	139.70(12)	O8 <sup>iv</sup> -Tb1-O2W	138.78(8)
	)		
O4 <sup>iv</sup> -Tb1-O2W	76.91(9)	O4 <sup>iv</sup> -Tb1-O2W	76.10(10)
O9-Tb1-O2W	73.03(9)	O9-Tb1-O2W	74.17(10)
O1W-Tb1-O2W	49.74(13)	O1W-Tb1-O2W	51.33(15)

Symmetry code(s): (i)  $x-y, x-1, z-1/6$ ; (ii)  $y, y-x, z-1/6$ ; (iii)  $y, y-x, 1/6+z$ ; (iv)  $x-y, x, 1/6+z$ .

**Table S3** The dihedral angles for ligand  $L^-$  in (1-4).

	SBUs	Dihedral angles (°)		
		Py/Ph ring	CO <sub>2</sub> <sup>-</sup> /Ph ring	-NO <sub>2</sub> /Ph ring
<i>L</i> -(1)	EuO <sub>8</sub>	58.2(3);51.3(3); 88.4(3)	1.8(3);12.5(3); 16.7(3)	22.5(3);55.3(3);3.0(3)
<i>D</i> -(1)	EuO <sub>8</sub>	56.4(3);54.7(2); 78.0(3)	3.4(3);12.0(3);14.2(2)	25.1(3);47.0(2);9.2(3)
<i>L</i> -(2)	GdO <sub>8</sub>	56.9(3);56.6(2);76.5(3)	4.4(3);11.5(2);14.4(2)	25.2(3);47.0(2);3.3(2)
<i>D</i> -(2)	GdO <sub>8</sub>	56.1(2);61.7(3); 78.2(2)	5.4(3);11.4(3);12.8(2)	27.0(2);50.6(2);7.1(3)
<i>L</i> -(3)	DyO <sub>8</sub>	58.0(3);57.0(3); 79.1(2)	4.3(2);11.6(2); 13.6(3)	24.3(2);48.7(3); 3.2(3)
<i>D</i> -(3)	DyO <sub>8</sub>	58.2(3);55.5(3);81.4(3)	6.1(3);11.0(3);13.9(3)	24.1(3);46.2(2);2.6(2)
<i>L</i> -(4)	TbO <sub>8</sub>	57.6(3);56.0(2); 79.2(3)	4.3(2);11.1(3);13.6(3)	24.9(2);43.4(3);3.3(3)
<i>D</i> -(4)	TbO <sub>8</sub>	58.1(3);55.9(2);81.9(2)	3.9(3); 11.9(2);14.4(3)	24.4(3);45.4(3);2.1(3)