A Series of Two-Dimensional Metal-Organic Frameworks Based on the Assembly of Rigid and Flexible Carboxylate-Containing Mixed Ligands with Lanthanide Metal Salts

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Table 1S. Selected Bond Lengths (Å) for complexes **2–4.** b–d Symmetry transformations used to generate equivalent atoms: [b]A -x+1,-y+2,-z; B -x,-y+2,-z; C x-1,y,z. [c]A -x+1,-y+1,-z+2; B -x,-y+1,-z+2; C x+1,y,z; D x-1,y,z. [d]A -x+1,-y,-z+1; B -x+2,-y,-z+1; C x+1,y,z.

		Complex 2[b]			
Eu1-O3A	2.368(5)5	Eu1-O5	2.372(7)	Eu1-O4B	2.388(6)
Eu1-O2	2.426(7)	Eu1-O3	2.426(5)	Eu1-O4	2.466(5)
Eu1-O10	2.502(6)	Eu1-O1	2.665(7)	Eu1-O9	2.744(6)
Eu2-O7	2.344(6)	Eu2-O8	2.356(6)	Eu2-O9C	2.392(6)
Eu2-O6	2.395(6)	Eu2-O4	2.406(6)	Eu2-O10	2.444(5)
Eu2-O1C	2.476(6)	Eu2-O3B	2.486(6)		
		Complex 3[c]			
Sm1-O2	2.381(3)	Sm1-O4	2.383(4)	Sm1-O3	2.405(3)
Sm1-O2A	2.436(3)	Sm1-O1	2.454(4)	Sm1-O3B	2.481(3)
Sm1-O10	2.514(3)	Sm1-O8C	2.667(4)	Sm1-O6C	2.753(4)
Sm2-O9	2.347(4)	Sm2-O7	2.354(3)	Sm2-O3B	2.404(3)
Sm2-O5	2.408(4)	Sm2-O6	2.414(3)	Sm2-O10	2.459(3)
Sm2-O2D	2.482(3)	Sm2-O8	2.492(4)		
		Complex 4[d]			
Pr1-O3	2.428(4)	Pr1-O5	2.434(5)	Pr1-O4	2.456(4)
Pr1-O3A	2.491(4)	Pr1-O1	2.515(5)	Pr1-O4B	2.516(4)
Pr1-O10	2.564(4)	Pr1-O2	2.716(5)	Pr1-O9	2.787(4)
Pr2-O7	2.394(4)	Pr2-O8	2.398(4)	Pr2-O6	2.456(5)
Pr2-O4B	2.463(4)	Pr2-O9C	2.471(4)	Pr2-O10	2.498(4)
Pr2-O3C	2.511(4)	Pr2-O2C	2.526(4)		

Table 2S. Selected Bond Angles (deg) for complexes **2–4.** b–d Symmetry transformations used to generate equivalent atoms: [b]A -x+1,-y+2,-z; B -x,-y+2,-z; C x-1,y,z. [c]A -x+1,-y+1,-z+2; B -x,-y+1,-z+2; C x+1,y,z; D x-1,y,z. [d]A -x+1,-y,-z+1; B -x+2,-y,-z+1; C x+1,y,z.

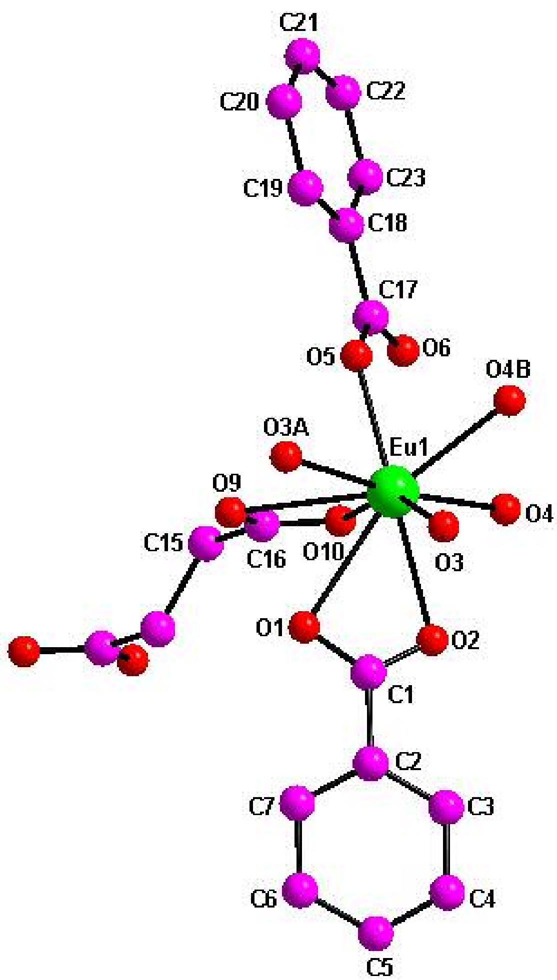
Complex 2[b]					
O8-Eu2-O9D	78.0(2)	O7-Eu2-O6	145.4(2)	O8-Eu2-O6	78.3(2)
O9C-Eu2-O6	104.1(2)	O7-Eu2-O4	101.0(2)	O8-Eu2-O4	147.28(19)
O9C-Eu2-O4	133.58(19)	O6-Eu2-O4	84.3(2)	O7-Eu2-O10	76.3(2)
O8-Eu2-O10	81.58(19)	O9C-Eu2-O10	159.4(2)	O6-Eu2-O10	74.5(2)
O4-Eu2-O10	67.06(18)	O7-Eu2-O1C	76.8(2)	O8-Eu2-O1C	136.2(2)
O9C-Eu2-O1C	69.1(2)	O6-Eu2-O1C	136.5(2)	O4-Eu2-O1D	73.9(2)
O10-Eu2-O1D	126.4(2)	O7-Eu2-O3B	146.0(2)	O8-Eu2-O3B	125.83(19)
O9C-Eu2-O3B	70.83(19)	O6-Eu2-O3B	68.2(2)	O4-Eu2-O3B	70.50(19)
O10-Eu2-O3B	125.15(19)	O1C-Eu2-O3B	69.2(2)	O3A-Eu1-O5	81.6(2)
O3A-Eu1-O4B	105.5(2)	O5-Eu1-O4B	73.6(2)	O3A-Eu1-O2	115.4(2)
O5-Eu1-O2	157.3(3)	O4B-Eu1-O2	113.0(2)	O3A-Eu1-O3	71.1(2)
O5-Eu1-O3	127.5(2)	O4B-Eu1-O3	71.83(19)	O2-Eu1-O3	74.2(2)
O3A-Eu1-O4	173.05(18)	O5-Eu1-O4	91.9(2)	O4B-Eu1-O4	70.1(2)
O2-Eu1-O4	71.5(2)	O3-Eu1-O4	111.54(18)	O3A-Eu1-O10	115.05(18)
O5-Eu1-O10	76.0(2)	O4B-Eu1-O10	124.20(19)	O2-Eu1-O10	82.8(2)
O3-Eu1-O10	156.3(2)	O4-Eu1-O10	65.25(18)	O3A-Eu1-O1	67.8(2)
O5-Eu1-O1	134.4(2)	O4B-Eu1-O1	145.5(2)	O2-Eu1-O1	51.0(2)
O3-Eu1-O1	74.15(19)	O4-Eu1-O1	118.9(2)	O10-Eu1-O1	86.9(2)
O3A-Eu1-O9	66.71(18)	O5-Eu1-O9	76.0(2)	O4B-Eu1-O9	149.5(2)
O2-Eu1-O9	96.4(2)	O3-Eu1-O9	127.09(18)	O4-Eu1-O9	114.19(18)
O10-Eu1-O9	48.96(18)	O1-Eu1-O9	61.3(2)		
Complex 3[c]					
O2-Sm1-O3	105.42(11)	O4-Sm1-O3	73.62(13)	O2-Sm1-O2A	71.39(12)
O2-Sm1-O4	81.81(12)	O4-Sm1-O2A	127.42(13)	O3-Sm1-O2A	71.36(11)
O2-Sm1-O1	115.14(12)	O4-Sm1-O1	157.11(13)	O3-Sm1-O1	113.37(12)
O2A-Sm1-O1	74.51(13)	O2-Sm1-O3B	173.49(11)	O4-Sm1-O3B	92.00(12)
O2A-Sm1-O3B	111.34(11)	O1-Sm1-O3B	71.37(11)	O3-Sm1-O3B	70.64(13)
O4-Sm1-O10	76.09(13)	O3-Sm1-O10	124.63(11)	O2-Sm1-O10	114.75(11)
O1-Sm1-O10	82.55(13)	O3B-Sm1-O10	65.29(11)	O2A-Sm1-O10	156.34(12)
O4-Sm1-O8C	134.78(13)	O3-Sm1-O8C	144.90(12)	O2-Sm1-O8C	67.56(11)
O1-Sm1-O8C	50.62(11)	O3B-Sm1-O8C	118.70(11)	O2A-Sm1-O8C	73.95(12)
O2-Sm1-O6C	67.20(11)	O4-Sm1-O6C	76.42(13)	O10-Sm1-O8C	87.14(12)
O2A-Sm1-O6C	127.65(10)	O1-Sm1-O6C	95.45(13)	O3-Sm1-O6C	149.91(12)
O10-Sm1-O6C	48.20(10)	O8C-Sm1-O6C	61.61(12)	O3B-Sm1-O6C	113.43(11)

O9-Sm2-O7	79.96(13)	O9-Sm2-O3B	100.74(12)	O2D-Sm2-O8	68.97(12)
O6-Sm2-O8	68.91(13)	O10-Sm2-O8	126.46(13)	O7-Sm2-O3B	147.40(11)
O9-Sm2-O5	145.43(12)	O7-Sm2-O5	78.38(13)	O3B-Sm2-O5	83.98(13)
O9-Sm2-O6	96.19(13)	O7-Sm2-O6	77.88(12)	O3B-Sm2-O6	133.65(11)
O5-Sm2-O6	105.14(14)	O9-Sm2-O10	76.19(13)	O7-Sm2-O10	81.55(12)
O3B-Sm2-O10	67.29(11)	O5-Sm2-O10	74.24(13)	O6-Sm2-O10	159.05(11)
O9-Sm2-O2D	146.05(11)	O7-Sm2-O2D	125.33(12)	O3B-Sm2-O2D	70.58(11)
O5-Sm2-O2D	67.94(12)	O6-Sm2-O2D	71.40(11)	O10-Sm2-O2D	125.20(11)
O9-Sm2-O8	77.09(12)	O7-Sm2-O8	136.81(13)	O3B-Sm2-O8	73.38(12)
O5-Sm2-O8	135.90(13)				

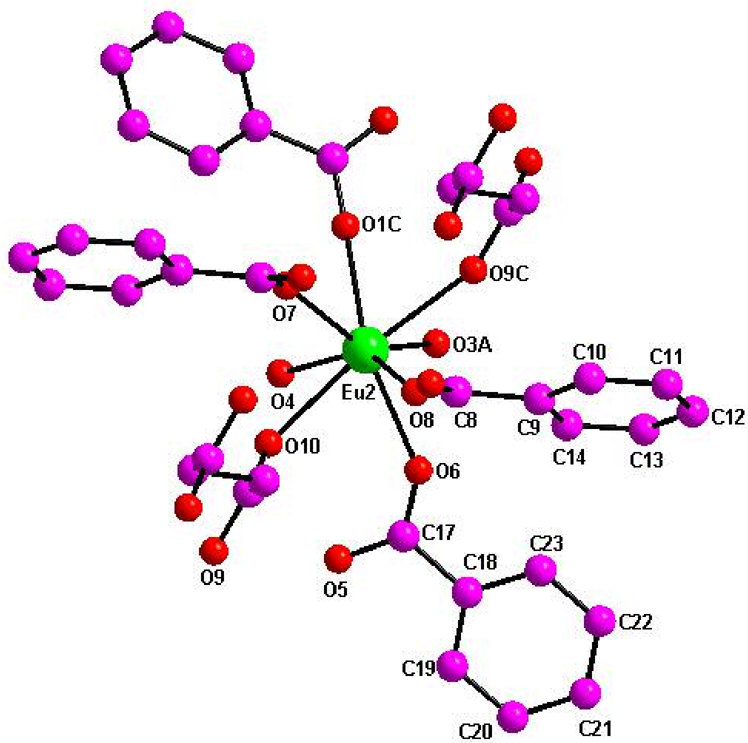
Complex 4[d]

O3-Pr1-O5	82.08(16)	O3-Pr1-O4	106.24(13)	O5-Pr1-O4	73.43(15)
O3-Pr1-O3A	71.49(14)	O5-Pr1-O3A	126.91(15)	O4-Pr1-O3A	71.25(13)
O3-Pr1-O1	113.23(14)	O5-Pr1-O1	158.71(18)	O4-Pr1-O1	113.56(14)
O3A-Pr1-O1	73.59(14)	O3-Pr1-O4B	175.25(11)	O5-Pr1-O4B	93.55(16)
O4-Pr1-O4B	70.55(14)	O3A-Pr1-O4B	110.09(13)	O1-Pr1-O4B	71.48(13)
O3-Pr1-O10	114.94(12)	O5-Pr1-O10	77.29(16)	O4-Pr1-O10	124.66(13)
O3A-Pr1-O10	155.70(15)	O1-Pr1-O10	82.63(15)	O4B-Pr1-O10	65.57(12)
O3-Pr1-O2	66.74(13)	O5-Pr1-O2	134.87(15)	O4-Pr1-O2	144.82(13)
O3A-Pr1-O2	73.99(13)	O1-Pr1-O2	49.66(13)	O4B-Pr1-O2	117.94(13)
O10-Pr1-O2	86.92(14)	O3-Pr1-O9	67.38(12)	O5-Pr1-O9	77.08(15)
O4-Pr1-O9	150.45(14)	O3A-Pr1-O9	128.00(12)	O1-Pr1-O9	94.75(14)
O4B-Pr1-O9	113.56(12)	O10-Pr1-O9	48.08(12)	O2-Pr1-O9	61.45(13)
O7-Pr2-O8	80.60(14)	O7-Pr2-O6	145.79(15)	O8-Pr2-O6	78.34(16)
O7-Pr2-O4B	100.96(13)	O8-Pr2-O4B	146.82(13)	O6-Pr2-O4B	83.04(16)
O7-Pr2-O9C	95.82(15)	O8-Pr2-O9C	78.28(14)	O6-Pr2-O9C	105.83(17)
O4B-Pr2-O9C	133.67(12)	O7-Pr2-O10	76.18(14)	O8-Pr2-O10	81.17(13)
O6-Pr2-O10	74.19(16)	O4B-Pr2-O10	67.37(12)	O9C-Pr2-O10	158.94(13)
O7-Pr2-O3C	146.27(13)	O8-Pr2-O3C	124.56(13)	O6-Pr2-O3C	67.32(14)
O4B-Pr2-O3C	70.79(13)	O9C-Pr2-O3C	71.41(13)	O10-Pr2-O3C	125.41(12)
O7-Pr2-O2C	77.67(14)	O8-Pr2-O2C	137.73(15)	O6-Pr2-O2C	134.78(15)
O4B-Pr2-O2C	73.46(14)	O9C-Pr2-O2C	68.49(15)	O10-Pr2-O2C	126.88(15)
O3C-Pr2-O2C	68.62(13)				

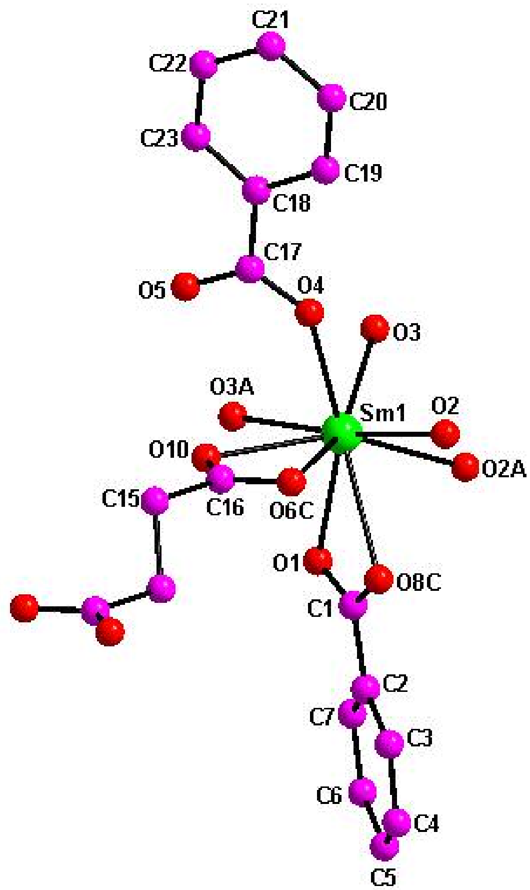
[1].(a)


C21
C20
C22
C19
C23
C18
C17
O5
O6
O4B
O3A
Eu1
O9
O4
C15
C16
O10
O3
O1
O2
C1
C2
C7
C3
C6
C4
C5

[1].(b)

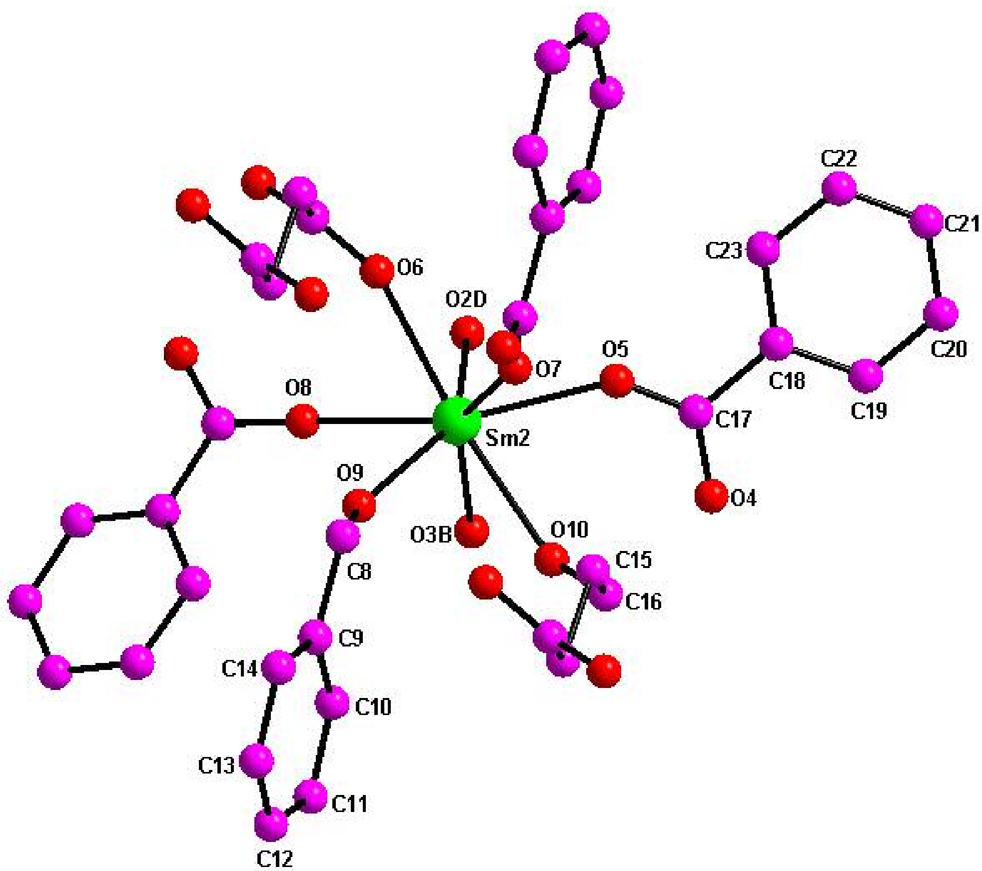

O1C
O9C
O7
O3A
C10
C11
O4
Eu2
O8
C8
C9
C12
O10
C14
C13
O6
C17
C23
C18
O9
O5
C22
C19
C20
C21

[2]. (a)



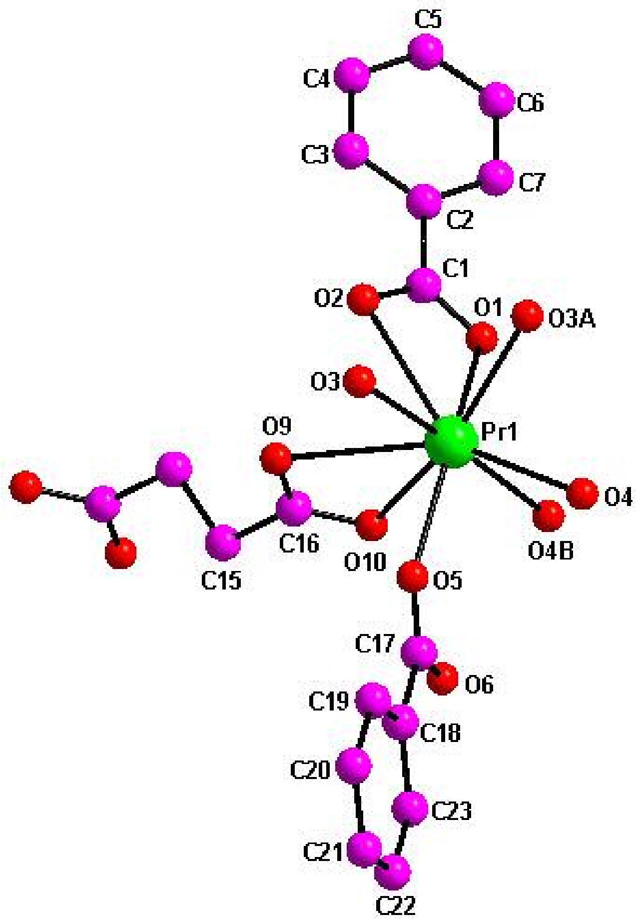
C21
C22
C20
C23
C19
C18
C17
O5
O4
O3
O3A
Sm1
O2
O10
O2A
C15
C16
O6C
O1
O8C
C1
C2
C7
C3
C6
C4
C5

[2].(b)



C22
C21
C23
O6
O2D
O7
O5
C20
O8
C18
C19
C17
Sm2
O9
O4
O3B
O10
C15
C8
C16
C9
C14
C10
C13
C11
C12

[3].(a)


C5
C4
C6
C3
C7
C2
C1
O2
O1
O3A
O3
Pr1
O9
O4
C16
O10
O4B
C15
O5
C17
O6
C19
C18
C20
C23
C21
C22

[3]. (b)

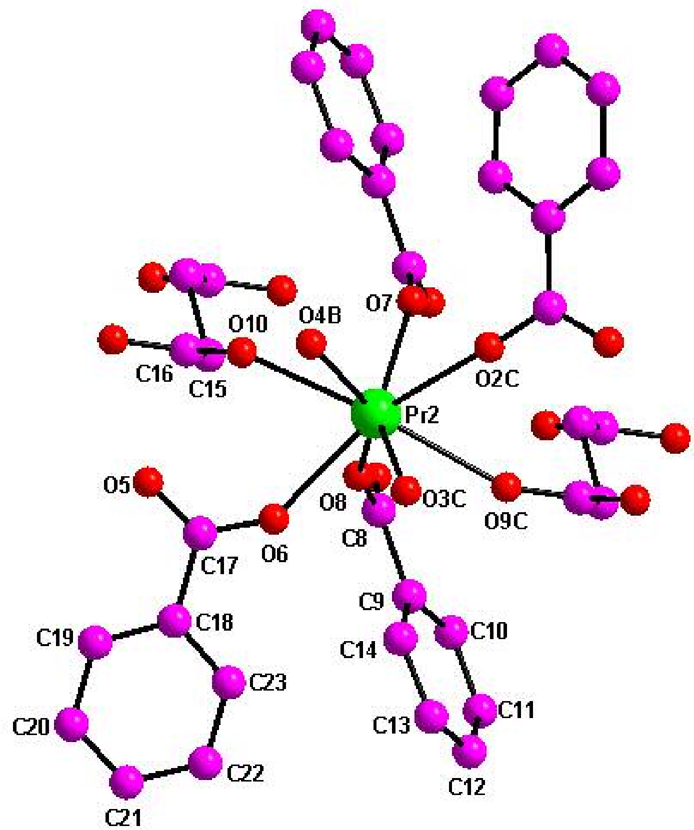

O10
O4B
O7
C16
C15
O2C
Pr2
O5
O8
O3C
O9C
C8
O6
C17
C9
C18
C19
C10
C14
C23
C11
C13
C20
C22
C12
C21

Figure 1S. **[1].**Coordination environments of (a) Eu1, (b) Eu2 in complex **2** with non-hydrogen atoms drawn by diamond. Symmetry codes follow: A -x+1,-y+2,-z; B -x,-y+2,-z; C x-1,y,z. **[2].**Coordination environments of (a) Sm1, (b) Sm2 in complex **3** with non-hydrogen atoms drawn by diamond. Symmetry codes follow: A -x+1,-y+1,-z+2; B -x,-y+1,-z+2; C x+1,y,z; D x-1,y,z. **[3].**Coordination environments of (a) Pr1, (b) Pr2 in complex **4** with non-hydrogen atoms drawn by diamond. Symmetry codes follow: A -x+1,-y,-z+1; B -x+2,-y,-z+1; C x+1,y,z.

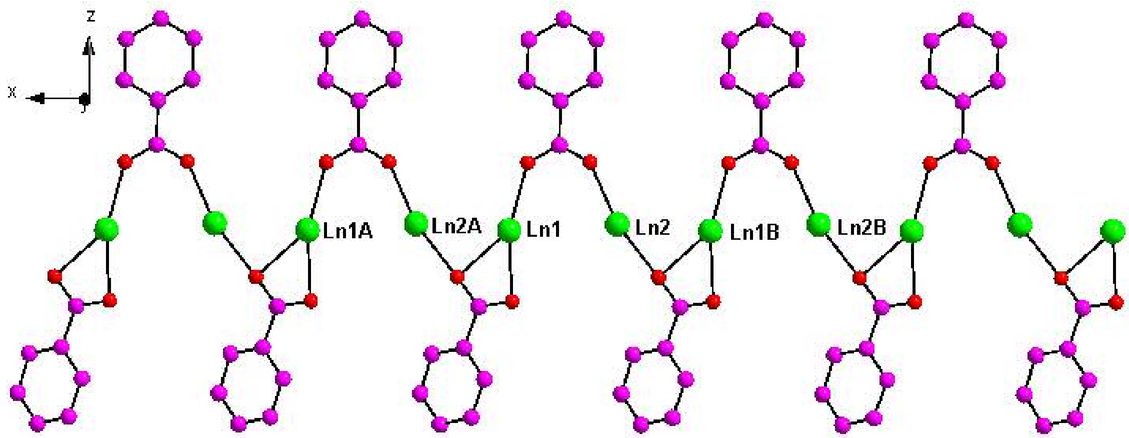
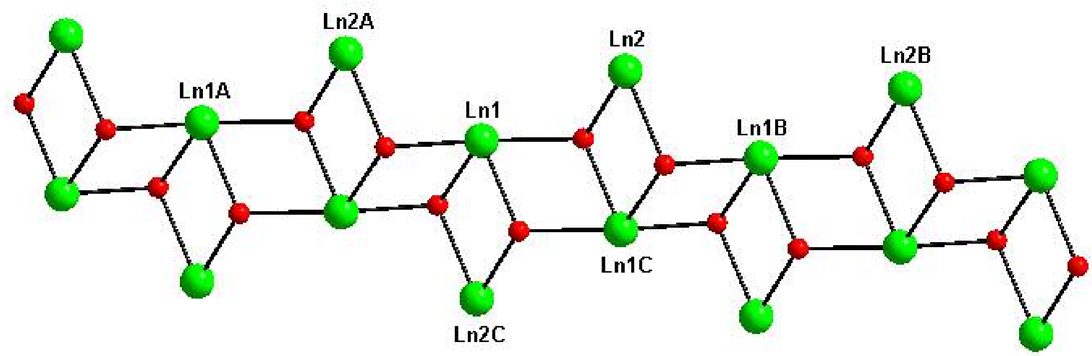
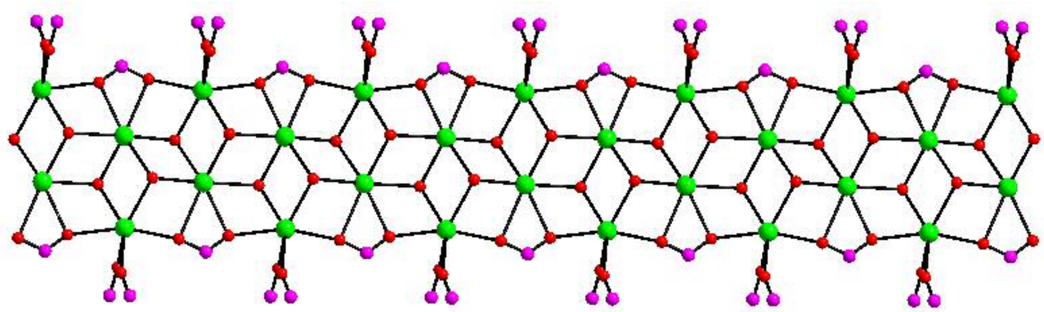


Figure 2S. One-dimensional chain structure formed Ln1, Ln2 (Ln=Eu(**2**), Sm(**3**), Pr(**4**)) and their corresponding centrosymmtric atoms and bezonic acid ligands on [101] plane. Hydrogen atoms and coordiantion water are omitted for clarity.

(a)



(b)



(c)

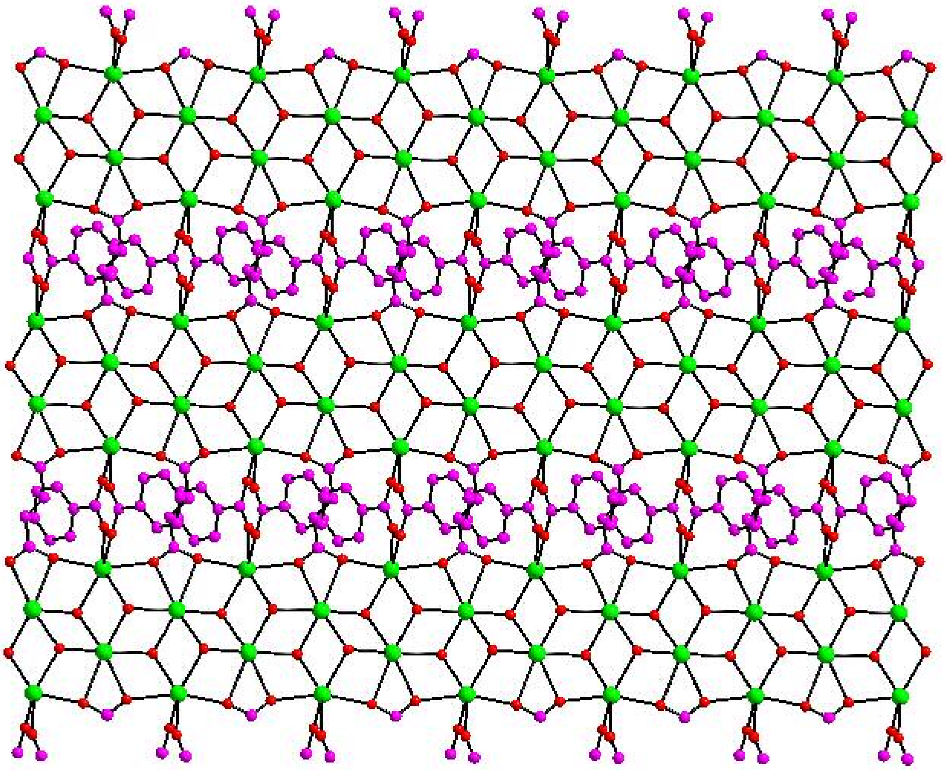
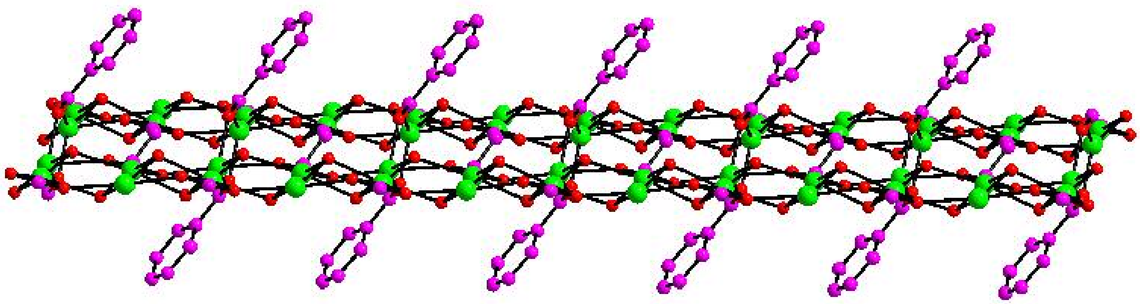
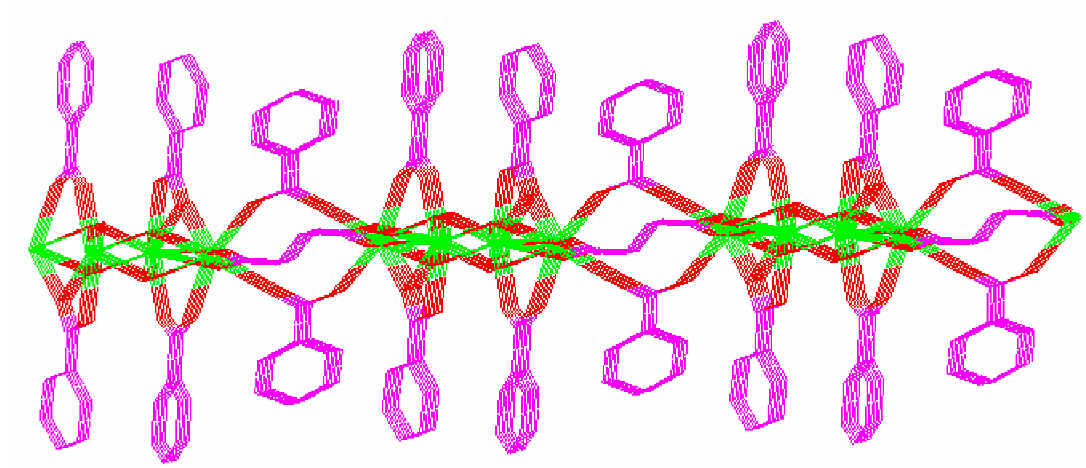


Figure 3S. (a) Absent-cube arrangement skeleton formed by μ_3-OH and Ln (Ln=Eu, Sm, Pr) ions of **2, 3, 4**. (b) Two lanthanide metal center atoms (Ln 1and Ln 2) Ln (Ln=Eu, Sm, Pr) and their centrosymmetric atoms linking by carboxyl groups of succinic acid ligands and μ_3-OH to lead to an infinite inorganic wall on [110] plane. (c) An infinite inorganic wall linked to each other by phenyl groups of benzoic acid ligands and the carbon atoms of the succinate anions. Hydrogen atoms and parts of benzoic acid are omitted for clarity.



Figrue 4S. The structure view of parallel phenyl rings of benzoic acid between two inorganic walls along the [100] direction of complex **2**, **3**, **4**.



Figrue 5S. Packing structure along the [100] direction of complex **2**, **3**, **4**.

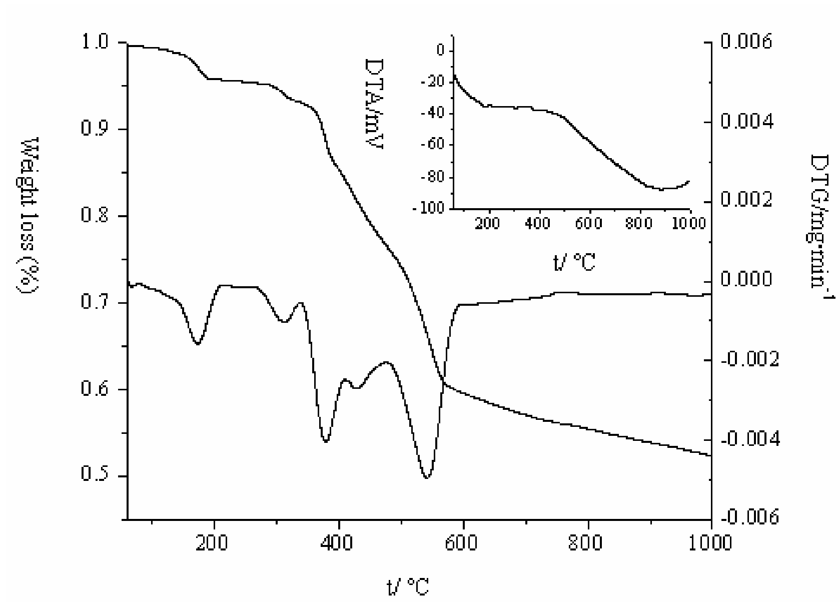


Figure 6S. The TG-DTG-DTA curve of complex **2**.

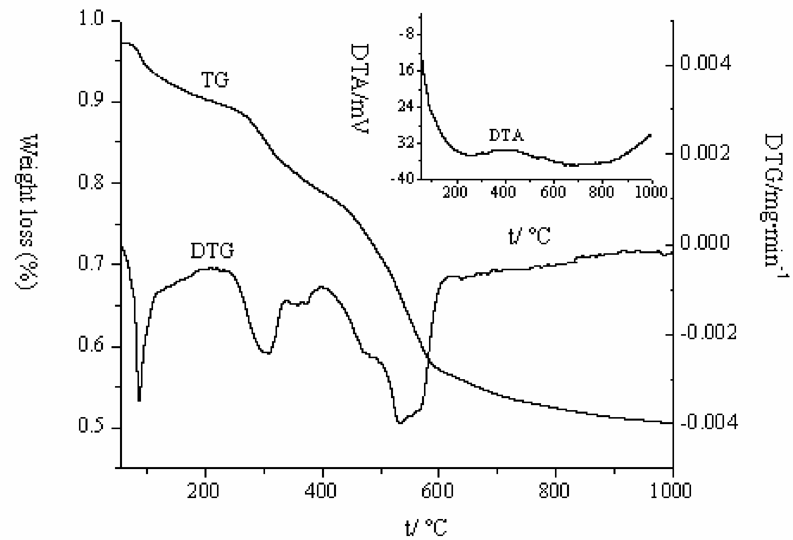


Figure 7S. The TG-DTG-DTA curve of complex **3**.

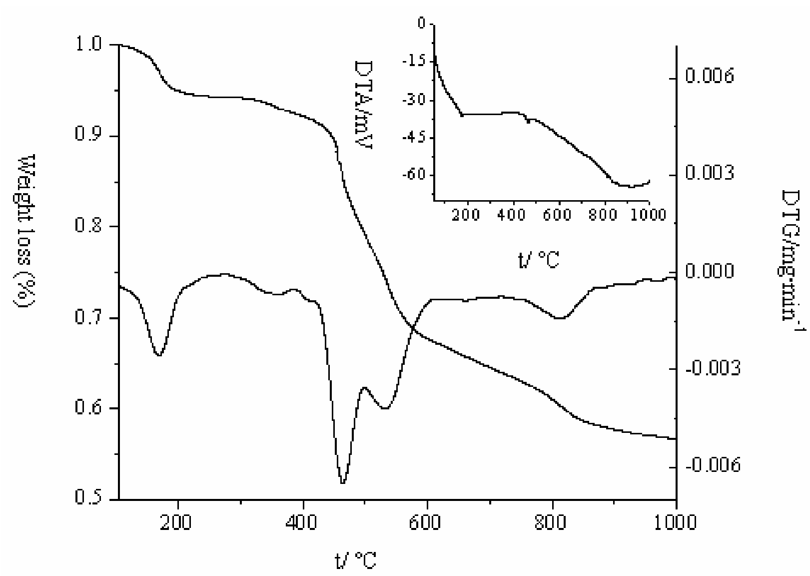


Figure 8S. The TG-DTG-DTA curve of complex **4**.

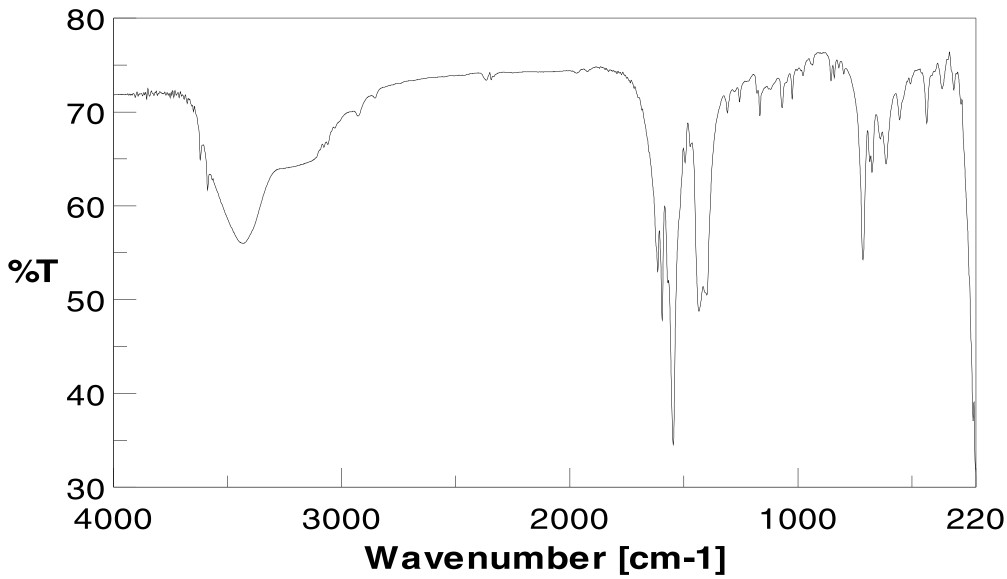


Figure 9S. The IR spectra of complex **1**.

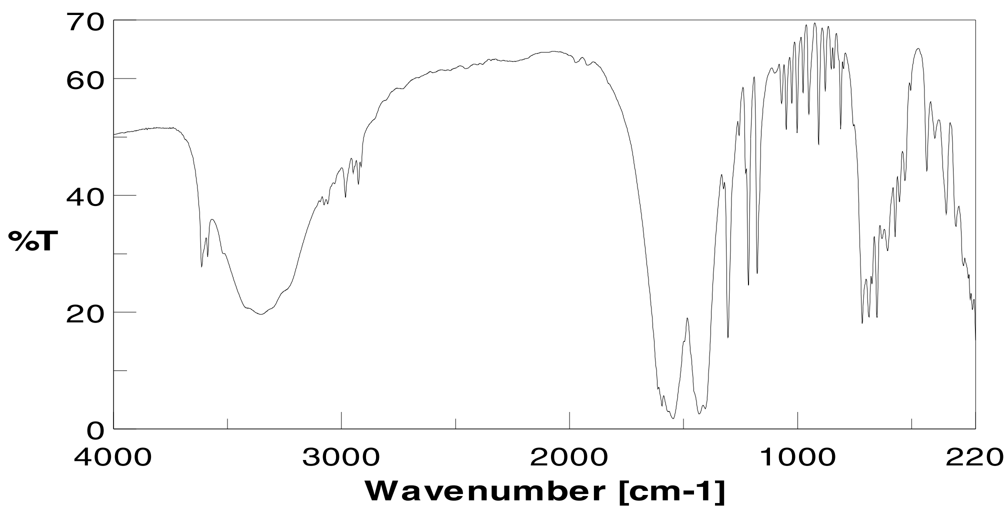


Figure 10S. The IR spectra of complex **2**.

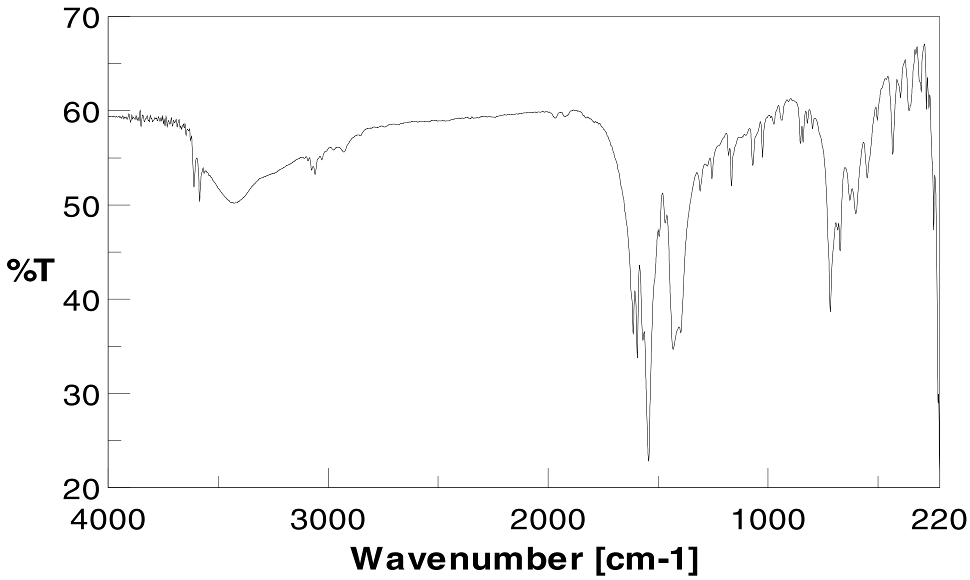


Figure 11S. The IR spectra of complex **3**.

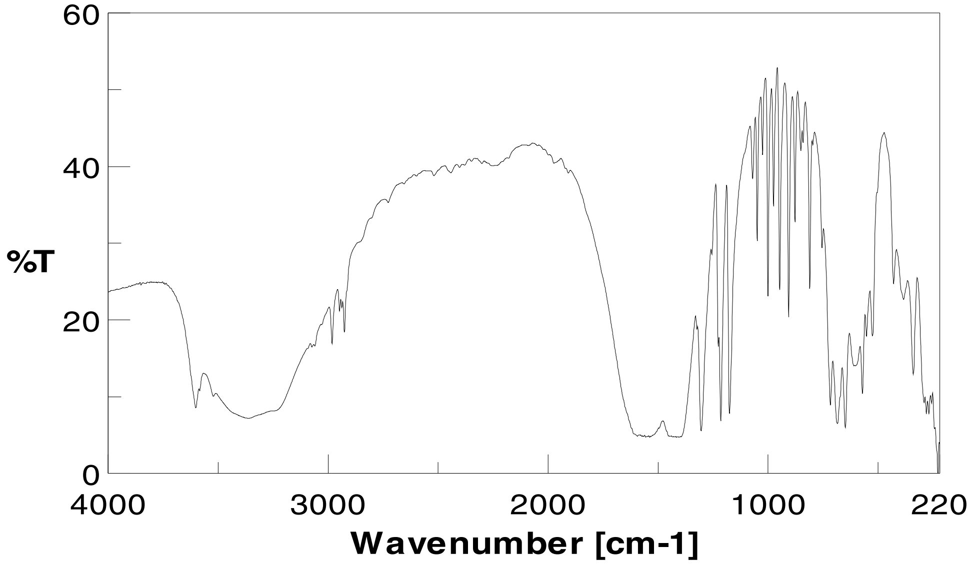


Figure 12S. The IR spectra of complex **4**.