Structure and Photoluminescence Tuning Features of Mn^{2+} and Ln^{3+} Activated Zn-Based Hetero-Metal-Organic Frameworks (MOFs) with Single 5-Methylisophthalic Acid Ligand

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Supporting Information

Table S1. Selected bond distances (Å) and angles (deg) for **Zn-Zn**.

(Symmetry codes: #1=x+1, -y+1/2, z+1/2; #2=-x, y-1/2, -z+1/2; #3=x+1, y, z ; #4=x-1, y, z ; #5=x-1, -y+1/2, z-1/2; #6= -x, y+1/2, -z+1/2)

Zn1-O3#1	1.9225(18)	C2-C1	1.391(4)	O1-Zn1#4	1.9567(19)
Zn1-O4#2	1.9466(18)	C2-C3	1.392(4)	C9-O4	1.259(3)
Zn1-O1#3	1.957(2)	C6-C1	1.376(4)	C9-O3	1.267(3)
Zn1-O2	1.9637(19)	C6-C5	1.402(3)	C9-C5	1.488(3)
O2-C8	1.266(3)	C4-C3	1.389(4)	O3-Zn1#5	1.9225(18)
C8-O1	1.253(3)	C4-C5	1.391(4)	O4-Zn1#6	1.9466(18)
C8-C3	1.497(4)	C1-C7	1.509(4)		
O3#1-Zn1-O4#2	123.72(8)	C1-C2-C3	121.3(2)	O4-C9-O3	123.7(2)
O3#1-Zn1-O1#3	117.62(8)	C1-C6-C5	121.3(2)	O4-C9-C5	118.6(2)
O4#2-Zn1-O1#3	100.40(8)	C3-C4-C5	119.6(2)	O3-C9-C5	117.7(2)
O3#1-Zn1-O2	107.35(8)	C6-C1-C2	118.3(2)	C4-C5-C6	119.5(2)
O4#2-Zn1-O2	103.57(8)	C6-C1-C7	121.3(2)	C4-C5-C9	120.6(2)
O1#3-Zn1-O2	101.30(8)	C2-C1-C7	120.4(2)	C6-C5-C9	119.9(2)
C8-O2-Zn1	127.66(17)	C4-C3-C2	119.8(2)	C9-O3-Zn1#5	120.72(17)
O1-C8-O2	123.3(2)	C4-C3-C8	120.1(2)	C9-O4-Zn1#6	135.52(18)
O1-C8-C3	117.2(2)	C2-C3-C8	120.0(2)		
O2-C8-C3	119.5(2)	C8-O1-Zn1#4	126.41(17)		

Table S2. Selected bond distances (Å) and angles (deg) for **Zn-Mn**.

(Symmetry codes: #1=-x+2, y, -z+1/2; #2=-x+2, -y+2, -z+1; #3 =x, -y+2, z-1/2; #4=x, y, z-1; #5=-x+3/2, -y+3/2, -z+1; #6=x, -y+2, z+1/2 ; #7=x, y, z+1)

Mn1-O5#1	2.192(3)	Zn1-O3#4	2.173(3)	C4-C3	1.389(6)
Mn1-O5	2.192(3)	O5-Mn1#2	2.255(3)	C4-C5	1.389(6)
Mn1-O1	2.200(3)	O4-C9	1.261(5)	C5-C7	1.516(6)
Mn1-O1#1	2.200(3)	O2-C8	1.256(6)	C3-C9#5	1.483(6)
Mn1-O5#2	2.255(3)	O1-C8	1.265(6)	O3-C9	1.276(5)
Mn1-O5#3	2.255(3)	C2-C3	1.385(6)	O3-Zn1#6	2.125(3)
Zn1-O5	2.017(3)	C2-C1	1.386(6)	O3-Zn1#7	2.173(3)
Zn1-O2	2.027(3)	C1-C6	1.390(6)	C9-C3#5	1.483(6)
Zn1-O4	2.042(3)	C1-C8	1.503(6)		
Zn1-O3#3	2.125(3)	C6-C5	1.383(7)		
O5#1-Mn1-O5	161.67(17)	O5-Zn1-O3#3	97.82(13)	O2-C8-C1	115.2(4)
O5#1-Mn1-O1	87.93(13)	O2-Zn1-O3#3	166.60(15)	O1-C8-C1	120.2(4)

O5-Mn1-O1	105.05(13)	O4-Zn1-O3#3	83.56(13)	C5-C6-C1	121.2(4)
O5#1-Mn1-O1#1	105.05(13)	O5-Zn1-O3#4	129.42(13)	C3-C4-C5	120.3(4)
O5-Mn1-O1#1	87.93(13)	O2-Zn1-O3#4	84.76(14)	C6-C5-C4	118.9(4)
O1-Mn1-O1#1	90.88(19)	O4-Zn1-O3#4	118.32(13)	C6-C5-C7	120.6(5)
O5#1-Mn1-O5#2	82.50(11)	O3#3-Zn1-O3#4	87.18(11)	C4-C5-C7	120.5(4)
O5-Mn1-O5#2	83.84(13)	Zn1-O5-Mn1	104.23(14)	C2-C3-C4	120.1(4)
O1-Mn1-O5#2	170.21(12)	Zn1-O5-Mn1#2	141.25(17)	C2-C3-C9#5	119.0(4)
O1#1-Mn1-O5#2	93.58(13)	Mn1-O5-Mn1#2	96.16(13)	C4-C3-C9#5	120.9(4)
O5#1-Mn1-O5#3	83.84(13)	C9-O4-Zn1	134.7(3)	C9-O3-Zn1#6	128.6(3)
O5-Mn1-O5#3	82.50(11)	C8-O2-Zn1	131.6(3)	C9-O3-Zn1#7	122.9(3)
O1-Mn1-O5#3	93.58(13)	C8-O1-Mn1	122.2(3)	Zn1#6-O3-Zn1#7	104.17(14)
O1#1-Mn1-O5#3	170.21(12)	C3-C2-C1	120.1(4)	O4-C9-O3	123.1(4)
O5#2-Mn1-O5#3	83.39(18)	C2-C1-C6	119.2(4)	O4-C9-C3#5	118.2(4)
O5-Zn1-O2	95.56(15)	C2-C1-C8	118.4(4)	O3-C9-C3#5	118.7(4)
O5-Zn1-O4	112.25(14)	C6-C1-C8	122.5(4)		
O2-Zn1-O4	90.86(13)	O2-C8-O1	124.6(4)		

Table S3. Selected bond distances (Å) and angles (deg) for **Mn-Mn**.

(Symmetry codes: #1=-x+1/2, y+1/2, -z+3/2; #2=-x+1, -y+1, -z+2; #3=-x+1, y, -z+3/2; #4=x, -y+1, z-1/2; #5=x, -y+1, z+1/2; #6=-x+1/2, y-1/2, -z+3/2)

O1-C8	1.253(6)	C7-C5	1.494(7)	Mn2-O3#5	2.087(3)
O1-Mn1	2.221(3)	C3-C9#1	1.491(6)	Mn2-O4	2.154(3)
O2-C8	1.244(6)	C5-C6	1.395(7)	Mn2-O4#4	2.214(3)
O2-Mn2	2.051(3)	O5-Mn2	2.100(3)	O4-C9	1.297(5)
C8-C1	1.501(6)	O5-Mn1	2.209(4)	O4-Mn2#5	2.214(3)
C1-C2	1.378(6)	O5-Mn1#2	2.249(3)	C9-O3	1.225(6)
C1-C6	1.390(7)	Mn1-O5#3	2.209(4)	C9-C3#6	1.491(6)
C2-C3	1.392(6)	Mn1-O1#3	2.221(3)	O3-Mn2#4	2.087(3)
C4-C3	1.382(7)	Mn1-O5#4	2.249(3)		
C4-C5	1.384(7)	Mn1-O5#2	2.249(3)		
C8-O1-Mn1	122.5(3)	Mn2-O5-Mn1#2	142.24(17)	O2-Mn2-O5	94.14(14)
C8-O2-Mn2	133.1(3)	Mn1-O5-Mn1#2	96.40(13)	O3#5-Mn2-O5	110.09(14)
O2-C8-O1	123.4(4)	O5#3-Mn1-O5	161.60(18)	O2-Mn2-O4	168.21(14)
O2-C8-C1	115.3(4)	O5#3-Mn1-O1	86.86(13)	O3#5-Mn2-O4	83.50(13)
O1-C8-C1	121.3(4)	O5-Mn1-O1	106.15(13)	O5-Mn2-O4	97.66(13)
C2-C1-C6	119.2(4)	O5#3-Mn1-O1#3	106.15(13)	O2-Mn2-O4#4	85.19(14)
C2-C1-C8	119.0(4)	O5-Mn1-O1#3	86.86(13)	O3#5-Mn2-O4#4	118.31(13)
C6-C1-C8	121.8(4)	O1-Mn1-O1#3	91.39(18)	O5-Mn2-O4#4	131.58(13)
C1-C2-C3	120.3(4)	O5#3-Mn1-O5#4	83.60(13)	O4-Mn2-O4#4	86.99(11)
C3-C4-C5	121.0(4)	O5-Mn1-O5#4	82.83(11)	C9-O4-Mn2	128.0(3)

C4-C3-C2	119.8(4)	O1-Mn1-O5#4	92.78(13)	C9-O4-Mn2#5	123.9(3)
C4-C3-C9#1	121.3(4)	O1#3-Mn1-O5#4	169.60(13)	Mn2-O4-Mn2#5	103.03(13)
C2-C3-C9#1	118.8(4)	O5#3-Mn1-O5#2	82.83(11)	O3-C9-O4	123.7(4)
C4-C5-C6	118.3(4)	O5-Mn1-O5#2	83.60(13)	O3-C9-C3#6	118.4(4)
C4-C5-C7	120.7(4)	O1-Mn1-O5#2	169.60(13)	O4-C9-C3#6	117.9(4)
C6-C5-C7	121.0(5)	O1#3-Mn1-O5#2	92.78(13)	C9-O3-Mn2#4	135.2(3)
C1-C6-C5	121.3(4)	O5#4-Mn1-O5#2	84.76(17)		
Mn2-O5-Mn1	102.44(13)	O2-Mn2-O3#5	92.46(14)		

Table S4. Selected bond distances (Å) and angles (deg) for **Zn-Sm**.

(Symmetry codes: #1=x-1, y, z; #2=-x+3/2, -y+1, z+1/2; #3=x-1/2, y, -z+1/2; #4=-x+1, -y+1, -z+1; #5= x, -y+3/2, z; #6=x+1, y, z; #7= -x+3/2, -y+1, z-1/2; #8=x+1/2, y, -z+1/2)

Sm1-O8#1	2.345(4)	C13-C12#5	1.392(7)	C2-C3	1.390(8)
Sm1-O5	2.369(4)	C13-C12	1.392(7)	C20-C19#5	1.394(9)
Sm1-O3#2	2.372(4)	C13-C14	1.508(12)	C20-C21	1.54(3)
Sm1-O4#3	2.394(4)	C10-C11	1.494(8)	C20-C21’	1.59(3)
Sm1-O9#4	2.449(4)	C15-C11#5	1.400(7)	O8-Sm1#6	2.345(4)
Sm1-O2#1	2.455(4)	C15-C11	1.400(7)	O2-Sm1#6	2.455(4)
Sm1-O9	2.511(4)	C11-C12	1.386(8)	O2-Sm1#4	2.709(4)
Sm1-O2#4	2.709(4)	O7-C16	1.273(8)	C9-C7	1.391(8)
Sm1-Sm1#4	3.9454(5)	C18-C17#5	1.382(7)	C3-C4	1.392(8)
Zn1-O6	1.929(4)	C18-C17	1.382(7)	C7-C6	1.396(8)
Zn1-O7	1.942(5)	C16-O8	1.254(7)	C7-C8	1.495(8)
Zn1-O1	1.946(4)	C16-C17	1.481(8)	C4-C6	1.382(8)
Zn1-O9	1.973(4)	C1-O2	1.284(7)	C4-C5	1.513(9)
O9-Sm1#4	2.449(4)	C1-C2	1.484(8)	C8-O4	1.262(7)
O5-C10	1.252(7)	C19-C17	1.384(8)	C8-O3	1.265(7)
O1-C1	1.269(7)	C19-C20	1.394(9)	O3-Sm1#7	2.372(4)
O6-C10	1.259(7)	C2-C9	1.385(8)	O4-Sm1#8	2.394(4)
O8#1-Sm1-O5	70.59(15)	O2#1-Sm1-Sm1#4	129.72(9)	O2-C1-C2	119.9(5)
O8#1-Sm1-O3#2	79.04(15)	O9-Sm1-Sm1#4	36.76(9)	C17-C19-C20	120.0(7)
O5-Sm1-O3#2	116.82(16)	O2#4-Sm1-Sm1#4	106.40(8)	C9-C2-C3	119.6(5)
O8#1-Sm1-O4#3	139.21(14)	O6-Zn1-O7	94.3(2)	C9-C2-C1	120.8(5)
O5-Sm1-O4#3	73.60(15)	O6-Zn1-O1	109.0(2)	C3-C2-C1	119.5(5)
O3#2-Sm1-O4#3	135.95(14)	O7-Zn1-O1	121.9(2)	C18-C17-C19	119.7(6)
O8#1-Sm1-O9#4	145.22(14)	O6-Zn1-O9	115.27(18)	C18-C17-C16	120.4(6)
O5-Sm1-O9#4	143.98(14)	O7-Zn1-O9	105.33(19)	C19-C17-C16	119.8(6)
O3#2-Sm1-O9#4	78.72(14)	O1-Zn1-O9	110.47(17)	C19-C20-C19#5	119.7(10)
O4#3-Sm1-O9#4	73.54(13)	Zn1-O9-Sm1#4	122.34(18)	C19-C20-C21	119.4(5)
O8#1-Sm1-O2#1	82.16(15)	Zn1-O9-Sm1	117.48(17)	C19#5-C20-C21	119.4(5)

05-Sm1-02#1	90.69(15)	Sm1#4-09-Sm1	105.40(14)	C19-C20-C21'	118.8(6)
03#2-Sm1-02#1	138.42(14)	C10-05-Sm1	148.8(4)	C19#5-C20-C21'	118.8(6)
04#3-Sm1-02#1	79.37(13)	C1-01-Zn1	119.6(4)	C21-C20-C21'	28.8(14)
09#4-Sm1-02#1	97.37(13)	C10-06-Zn1	126.0(4)	C16-08-Sm1#6	144.1(4)
08#1-Sm1-09	120.11(15)	C12#5-C13-C12	117.5(7)	C1-02-Sm1#6	125.7(3)
05-Sm1-09	81.69(14)	C12#5-C13-C14	121.3(4)	C1-02-Sm1#4	120.6(3)
03#2-Sm1-09	67.83(13)	C12-C13-C14	121.3(4)	Sm1#6-02-Sm1#4	112.96(14)
04#3-Sm1-09	72.18(13)	05-C10-06	124.3(6)	C2-C9-C7	119.6(5)
09#4-Sm1-09	74.60(14)	05-C10-C11	119.3(5)	C2-C3-C4	121.6(5)
02#1-Sm1-09	151.55(13)	06-C10-C11	116.4(5)	C9-C7-C6	119.9(5)
08#1-Sm1-02#4	72.38(14)	C11#5-C15-C11	119.9(8)	C9-C7-C8	121.9(5)
05-Sm1-02#4	138.90(13)	C12-C11-C15	119.1(6)	C6-C7-C8	118.2(5)
03#2-Sm1-02#4	72.00(13)	C12-C11-C10	122.0(5)	C6-C4-C3	118.0(6)
04#3-Sm1-02#4	130.18(13)	C15-C11-C10	118.8(5)	C6-C4-C5	120.7(6)
09#4-Sm1-02#4	75.48(12)	C11-C12-C13	122.1(6)	C3-C4-C5	121.3(6)
02#1-Sm1-02#4	67.04(14)	C16-07-Zn1	129.5(4)	04-C8-03	124.2(5)
09-Sm1-02#4	133.49(12)	C17#5-C18-C17	120.8(8)	04-C8-C7	118.3(5)
08#1-Sm1-Sm1#4	146.00(12)	08-C16-07	122.9(6)	03-C8-C7	117.5(5)
05-Sm1-Sm1#4	114.21(11)	08-C16-C17	121.1(6)	C4-C6-C7	121.2(5)
03#2-Sm1-Sm1#4	68.80(10)	07-C16-C17	116.0(5)	C8-03-Sm1#7	137.3(4)
04#3-Sm1-Sm1#4	68.24(10)	01-C1-02	122.4(5)	C8-04-Sm1#8	138.0(4)
09#4-Sm1-Sm1#4	37.85(9)	01-C1-C2	117.7(5)		

Table S5. Selected bond distances (Å) and angles (deg) for **Zn-Eu1**.

(Symmetry codes:#1=x-1, y, z; #2=-x+1/2, -y+1, z-1/2; #3= x-1/2, y, -z+1/2; #4=-x, -y+1, -z; #5=-x-1, -y+1, -z; #6=x, -y+3/2, z; #7=x+1, y, z; #8=-x+1/2, -y+1, z+1/2; #9=x+1/2, y, -z+1/2)

Eu1-08#1	2.3234(15)	05-C10	1.248(2)	C2-C9	1.383(3)
Eu1-05	2.3475(14)	C11-C15	1.384(2)	C2-C3	1.392(3)
Eu1-03#2	2.3558(13)	C11-C12	1.389(3)	C9-C7	1.396(3)
Eu1-04#3	2.3770(13)	C11-C10	1.502(3)	C3-C4	1.384(3)
Eu1-02#1	2.4308(13)	C15-C11#6	1.384(2)	C18-C17#6	1.385(2)
Eu1-09#4	2.4319(13)	C12-C13	1.385(2)	C19-C20	1.382(3)
Eu1-09	2.5040(13)	C13-C12#6	1.385(2)	C20-C19#6	1.382(3)
Eu1-02#4	2.7126(13)	C13-C14	1.502(4)	C20-C21	1.504(8)
Eu1-Zn1	3.8297(3)	07-C16	1.253(3)	C20-C21B	1.640(16)
Eu1-Eu1#4	3.9201(3)	C16-08	1.254(2)	C20-C21A	1.667(16)
Eu1-Eu1#5	4.3008(3)	C16-C17	1.488(3)	C7-C6	1.384(3)
Zn1-06	1.9278(15)	C17-C19	1.379(3)	C7-C8	1.494(3)
Zn1-07	1.9369(15)	C17-C18	1.385(2)	C4-C6	1.377(3)
Zn1-01	1.9406(14)	08-Eu1#7	2.3234(14)	C4-C5	1.502(3)
Zn1-09	1.9560(13)	C1-02	1.284(2)	C8-04	1.250(2)

09-Eu1#4	2.4319(13)	C1-C2	1.487(3)	C8-03	1.264(2)
01-C1	1.253(2)	02-Eu1#7	2.4308(13)	03-Eu1#8	2.3558(13)
06-C10	1.256(2)	02-Eu1#4	2.7126(13)	04-Eu1#9	2.3770(13)
08#1-Eu1-05	70.77(5)	09-Eu1-Eu1#4	36.78(3)	07-C16-C17	116.37(17)
08#1-Eu1-03#2	78.55(5)	02#4-Eu1-Eu1#4	106.73(3)	08-C16-C17	119.20(18)
05-Eu1-03#2	117.11(5)	Zn1-Eu1-Eu1#4	59.653(6)	C19-C17-C18	119.3(2)
08#1-Eu1-04#3	139.44(5)	08#1-Eu1-Eu1#5	74.67(4)	C19-C17-C16	121.16(19)
05-Eu1-04#3	73.38(5)	05-Eu1-Eu1#5	118.82(4)	C18-C17-C16	119.48(19)
03#2-Eu1-04#3	136.11(5)	03#2-Eu1-Eu1#5	102.98(3)	C16-08-Eu1#7	144.21(13)
08#1-Eu1-02#1	82.61(5)	04#3-Eu1-Eu1#5	107.76(3)	01-C1-02	122.59(17)
05-Eu1-02#1	90.81(5)	02#1-Eu1-Eu1#5	35.38(3)	01-C1-C2	117.75(16)
03#2-Eu1-02#1	138.00(4)	09#4-Eu1-Eu1#5	85.00(3)	02-C1-C2	119.65(17)
04#3-Eu1-02#1	79.54(4)	09-Eu1-Eu1#5	159.18(3)	C1-02-Eu1#7	126.05(12)
08#1-Eu1-09#4	144.84(5)	02#4-Eu1-Eu1#5	31.26(3)	C1-02-Eu1#4	119.75(11)
05-Eu1-09#4	144.14(5)	Zn1-Eu1-Eu1#5	168.570(5)	Eu1#7-02-Eu1#4	113.36(5)
03#2-Eu1-09#4	78.49(5)	Eu1#4-Eu1-Eu1#5	122.890(7)	C9-C2-C3	119.97(17)
04#3-Eu1-09#4	73.87(4)	06-Zn1-07	94.46(7)	C9-C2-C1	120.56(18)
02#1-Eu1-09#4	97.26(4)	06-Zn1-01	108.96(6)	C3-C2-C1	119.32(16)
08#1-Eu1-09	119.73(5)	07-Zn1-01	122.02(6)	C2-C9-C7	118.88(18)
05-Eu1-09	81.48(5)	06-Zn1-09	115.14(6)	C4-C3-C2	121.35(17)
03#2-Eu1-09	68.29(4)	07-Zn1-09	105.32(6)	C17-C18-C17#6	120.4(3)
04#3-Eu1-09	71.94(4)	01-Zn1-09	110.42(6)	C17-C19-C20	121.2(2)
02#1-Eu1-09	151.48(4)	06-Zn1-Eu1	81.61(5)	C19-C20-C19#6	118.7(3)
09#4-Eu1-09	74.85(5)	07-Zn1-Eu1	120.95(5)	C19-C20-C21	120.65(16)
08#1-Eu1-02#4	72.30(5)	01-Zn1-Eu1	114.62(4)	C19#6-C20-C21	120.65(16)
05-Eu1-02#4	138.72(5)	09-Zn1-Eu1	35.33(4)	C19-C20-C21B	118.2(2)
03#2-Eu1-02#4	71.95(4)	Zn1-09-Eu1#4	122.59(6)	C19#6-C20-C21B	118.2(2)
04#3-Eu1-02#4	130.26(4)	Zn1-09-Eu1	117.81(6)	C21-C20-C21B	22.2(6)
02#1-Eu1-02#4	66.64(5)	Eu1#4-09-Eu1	105.15(5)	C19-C20-C21A	118.7(2)
09#4-Eu1-02#4	75.45(4)	C1-01-Zn1	119.56(12)	C19#6-C20-C21A	118.7(2)
09-Eu1-02#4	134.00(4)	C10-06-Zn1	125.63(14)	C21-C20-C21A	19.0(7)
08#1-Eu1-Zn1	109.60(4)	C10-05-Eu1	149.15(14)	C21B-C20-C21A	41.2(8)
05-Eu1-Zn1	55.32(4)	C15-C11-C12	120.00(19)	C6-C7-C9	120.03(17)
03#2-Eu1-Zn1	88.36(3)	C15-C11-C10	118.47(18)	C6-C7-C8	118.93(17)
04#3-Eu1-Zn1	61.90(3)	C12-C11-C10	121.49(18)	C9-C7-C8	121.04(18)
02#1-Eu1-Zn1	133.48(3)	C11-C15-C11#6	119.6(3)	C6-C4-C3	118.07(19)
09#4-Eu1-Zn1	95.98(3)	05-C10-06	124.44(19)	C6-C4-C5	121.16(19)
09-Eu1-Zn1	26.86(3)	05-C10-C11	119.29(18)	C3-C4-C5	120.77(18)
02#4-Eu1-Zn1	159.63(3)	06-C10-C11	116.24(17)	C4-C6-C7	121.54(19)
08#1-Eu1-Eu1#4	145.48(4)	C13-C12-C11	120.87(19)	04-C8-03	124.40(17)
05-Eu1-Eu1#4	114.09(4)	C12-C13-C12#6	118.6(3)	04-C8-C7	119.00(17)
03#2-Eu1-Eu1#4	68.89(3)	C12-C13-C14	120.72(13)	03-C8-C7	116.59(17)
04#3-Eu1-Eu1#4	68.26(3)	C12#6-C13-C14	120.72(13)	C8-03-Eu1#8	137.07(12)
02#1-Eu1-Eu1#4	129.76(3)	C16-07-Zn1	129.15(13)	C8-04-Eu1#9	138.14(12)
09#4-Eu1-Eu1#4	38.06(3)	07-C16-08	124.44(19)		

Table S6. Selected bond distances (Å) and angles (deg) for **Zn-Eu2**.

(Symmetry codes: #1=-x+1, -y+1, -z; #2=-x+2, -y+1, -z+1; #3=-x+2, -y+2, -z+1; #4=-x+2, -y+1, -z; #5=x-1, y-1, z-1; #6=-x+1, -y+1, -z+1; #7=x+1, y+1, z+1)

Eu1-O5	2.327(3)	O9-C19	1.246(5)	C20-C21	1.392(6)
Eu1-O9	2.333(3)	O10-C19	1.258(5)	C21-C22	1.386(6)
Eu1-O19	2.336(3)	O11-C25	1.266(5)	C22-C24	1.382(6)
Eu1-O2	2.340(3)	O11-Zn1#3	1.990(3)	C22-C23	1.508(7)
Eu1-O23#1	2.366(3)	O12-C25	1.241(5)	C24-C26	1.377(6)
Eu1-O16#2	2.413(3)	O12-Zn5#6	1.950(3)	C25-C26	1.506(6)
Eu1-O2W	2.536(3)	O13-C28	1.254(5)	C26-C27	1.388(6)
Eu1-O1W	2.556(3)	O14-C28	1.257(5)	C28-C29	1.487(6)
Zn1-O1	1.936(3)	O15-C34	1.266(5)	C29-C30	1.378(6)
Zn1-O24#1	1.951(3)	O15-Zn2#2	1.974(3)	C29-C36	1.390(6)
Zn1-O6	1.962(3)	O16-C34	1.243(5)	C30-C31	1.389(6)
Zn1-O11#3	1.990(3)	O16-Eu1#2	2.413(3)	C31-C33	1.395(6)
Zn2-O20	1.931(3)	O19-C41	1.256(5)	C31-C32	1.492(7)
Zn2-O10	1.935(3)	O20-C41	1.264(5)	C33-C35	1.381(6)
Zn2-O15#2	1.974(3)	O21-C46	1.268(5)	C34-C35	1.489(6)
Zn2-O13	1.989(3)	O22-C46	1.247(5)	C35-C36	1.384(6)
Zn3-O4#4	1.949(3)	O23-C53	1.242(5)	C38-C39	1.381(5)
Zn3-O17#1	1.957(3)	O23-Eu1#1	2.366(3)	C38-C45	1.391(5)
Zn3-O14	1.971(3)	O24-C53	1.279(5)	C38-C37	1.496(5)
Zn3-O25	2.032(3)	O24-Zn1#1	1.951(3)	C39-C40	1.394(5)
Zn4-O18#1	1.980(3)	C1-C2	1.503(6)	C40-C42	1.384(5)
Zn4-O7#5	2.037(3)	C2-C9	1.380(5)	C40-C41	1.488(5)
Zn4-O25	2.043(3)	C2-C3	1.394(6)	C42-C43	1.383(6)
Zn4-O3#4	2.093(3)	C3-C4	1.386(6)	C43-C45	1.390(5)
Zn4-O22	2.148(3)	C4-C6	1.398(6)	C43-C44	1.514(6)
Zn5-O21	1.937(3)	C4-C5	1.503(6)	C46-C47	1.491(6)
Zn5-O12#6	1.950(3)	C6-C7	1.381(6)	C47-C54	1.382(6)
Zn5-O25	1.960(3)	C7-C9	1.390(5)	C47-C48	1.393(6)
Zn5-O3W	2.010(3)	C7-C8	1.496(5)	C48-C49	1.392(6)
O1-C1	1.284(5)	C10-C11	1.480(6)	C49-C51	1.391(6)
O2-C1	1.244(5)	C11-C12	1.383(6)	C49-C50	1.499(6)
O3-C8	1.252(5)	C11-C18	1.388(6)	C51-C52	1.389(6)
O3-Zn4#4	2.093(3)	C12-C13	1.390(6)	C52-C54	1.390(6)
O4-C8	1.274(5)	C13-C15	1.402(6)	C52-C53	1.490(6)
O4-Zn3#4	1.949(3)	C13-C14	1.503(6)	C37-O18	1.248(5)
O5-C10	1.252(5)	C15-C17	1.382(6)	C37-O17	1.268(5)
O6-C10	1.265(5)	C16-C17	1.509(6)	O17-Zn3#1	1.957(3)
O7-C16	1.272(5)	C17-C18	1.372(6)	O18-Zn4#1	1.980(3)

O7-Zn4#7	2.037(3)	C19-C20	1.497(6)		
O8-C16	1.249(5)	C20-C27	1.376(6)		
O5-Eu1-O9	98.31(12)	C10-O5-Eu1	170.7(3)	C26-C24-C22	121.7(4)
O5-Eu1-O19	148.96(11)	C10-O6-Zn1	109.6(3)	O12-C25-O11	125.0(4)
O9-Eu1-O19	84.02(11)	C16-O7-Zn4#7	101.4(3)	O12-C25-C26	115.7(4)
O5-Eu1-O2	80.51(11)	C19-O9-Eu1	150.4(3)	O11-C25-C26	119.3(4)
O9-Eu1-O2	152.71(12)	C19-O10-Zn2	129.0(3)	C24-C26-C27	119.6(4)
O19-Eu1-O2	83.59(11)	C25-O11-Zn1#3	131.8(3)	C24-C26-C25	119.8(4)
O5-Eu1-O23#1	89.64(11)	C25-O12-Zn5#6	131.3(3)	C27-C26-C25	120.5(4)
O9-Eu1-O23#1	135.13(11)	C28-O13-Zn2	141.1(3)	C20-C27-C26	120.0(4)
O19-Eu1-O23#1	110.56(11)	C28-O14-Zn3	106.7(3)	O13-C28-O14	119.7(4)
O2-Eu1-O23#1	72.13(12)	C34-O15-Zn2#2	105.6(3)	O13-C28-C29	122.6(4)
O5-Eu1-O16#2	74.53(11)	C34-O16-Eu1#2	153.9(3)	O14-C28-C29	117.6(4)
O9-Eu1-O16#2	78.45(11)	C41-O19-Eu1	152.4(3)	C30-C29-C36	118.9(4)
O19-Eu1-O16#2	75.68(10)	C41-O20-Zn2	122.0(3)	C30-C29-C28	119.8(4)
O2-Eu1-O16#2	74.96(12)	C46-O21-Zn5	111.4(3)	C36-C29-C28	121.0(4)
O23#1-Eu1-O16#2	145.38(11)	C46-O22-Zn4	129.5(3)	C29-C30-C31	122.9(4)
O5-Eu1-O2W	140.71(11)	C53-O23-Eu1#1	135.8(3)	C30-C31-C33	116.4(4)
O9-Eu1-O2W	76.90(12)	C53-O24-Zn1#1	123.1(3)	C30-C31-C32	122.2(5)
O19-Eu1-O2W	70.11(11)	Zn5-O25-Zn3	116.07(13)	C33-C31-C32	121.4(5)
O2-Eu1-O2W	120.90(12)	Zn5-O25-Zn4	115.47(13)	C35-C33-C31	122.0(4)
O23#1-Eu1-O2W	69.69(11)	Zn3-O25-Zn4	97.66(11)	O16-C34-O15	122.3(4)
O16#2-Eu1-O2W	139.40(11)	O2-C1-O1	124.4(4)	O16-C34-C35	119.6(4)
O5-Eu1-O1W	70.11(11)	O2-C1-C2	118.8(4)	O15-C34-C35	118.1(4)
O9-Eu1-O1W	69.70(11)	O1-C1-C2	116.8(4)	C33-C35-C36	119.7(4)
O19-Eu1-O1W	137.55(11)	C9-C2-C3	120.3(4)	C33-C35-C34	120.3(4)
O2-Eu1-O1W	133.05(11)	C9-C2-C1	118.8(4)	C36-C35-C34	119.8(4)
O23#1-Eu1-O1W	71.92(11)	C3-C2-C1	120.7(4)	C35-C36-C29	119.7(4)
O16#2-Eu1-O1W	127.34(11)	C4-C3-C2	120.5(4)	C39-C38-C45	119.6(4)
O2W-Eu1-O1W	71.78(12)	C3-C4-C6	118.4(4)	C39-C38-C37	118.9(4)
O1-Zn1-O24#1	113.76(14)	C3-C4-C5	120.8(4)	C45-C38-C37	121.5(4)
O1-Zn1-O6	119.91(14)	C6-C4-C5	120.8(4)	C38-C39-C40	120.4(4)
O24#1-Zn1-O6	112.50(14)	C7-C6-C4	121.5(4)	C42-C40-C39	119.0(4)
O1-Zn1-O11#3	108.25(13)	C6-C7-C9	119.3(4)	C42-C40-C41	121.7(3)
O24#1-Zn1-O11#3	98.06(13)	C6-C7-C8	121.5(4)	C39-C40-C41	119.2(4)
O6-Zn1-O11#3	100.89(14)	C9-C7-C8	119.2(4)	O19-C41-O20	123.6(4)
O20-Zn2-O10	118.96(14)	O3-C8-O4	126.1(4)	O19-C41-C40	118.9(3)
O20-Zn2-O15#2	123.47(14)	O3-C8-C7	119.4(4)	O20-C41-C40	117.4(4)
O10-Zn2-O15#2	110.64(15)	O4-C8-C7	114.5(4)	C43-C42-C40	121.6(4)
O20-Zn2-O13	97.91(12)	C2-C9-C7	120.0(4)	C42-C43-C45	118.6(4)
O10-Zn2-O13	96.73(13)	O5-C10-O6	121.4(4)	C42-C43-C44	121.0(4)
O15#2-Zn2-O13	101.67(13)	O5-C10-C11	119.9(4)	C45-C43-C44	120.4(4)
O4#4-Zn3-O17#1	111.27(12)	O6-C10-C11	118.8(4)	C43-C45-C38	120.8(4)
O4#4-Zn3-O14	127.19(13)	C12-C11-C18	119.1(4)	O22-C46-O21	124.0(4)
O17#1-Zn3-O14	110.90(13)	C12-C11-C10	121.1(4)	O22-C46-C47	118.7(4)

04#4-Zn3-025	96.67(11)	C18-C11-C10	119.8(4)	021-C46-C47	117.2(4)
017#1-Zn3-025	110.99(12)	C11-C12-C13	122.2(4)	C54-C47-C48	119.5(4)
014-Zn3-025	96.57(12)	C12-C13-C15	117.1(4)	C54-C47-C46	119.1(4)
018#1-Zn4-07#5	141.45(12)	C12-C13-C14	121.9(4)	C48-C47-C46	121.4(4)
018#1-Zn4-025	105.90(11)	C15-C13-C14	121.0(4)	C49-C48-C47	121.8(4)
07#5-Zn4-025	110.86(11)	C17-C15-C13	120.8(4)	C51-C49-C48	117.2(4)
018#1-Zn4-03#4	91.64(12)	08-C16-07	121.2(4)	C51-C49-C50	120.5(4)
07#5-Zn4-03#4	98.38(12)	08-C16-C17	119.6(4)	C48-C49-C50	122.2(4)
025-Zn4-03#4	91.69(11)	07-C16-C17	119.2(4)	C52-C51-C49	121.9(4)
018#1-Zn4-022	85.26(12)	C18-C17-C15	120.6(4)	C51-C52-C54	119.4(4)
07#5-Zn4-022	86.74(12)	C18-C17-C16	119.0(4)	C51-C52-C53	120.7(4)
025-Zn4-022	84.99(11)	C15-C17-C16	120.2(4)	C54-C52-C53	119.9(4)
03#4-Zn4-022	174.65(11)	C17-C18-C11	119.9(4)	023-C53-024	123.5(4)
021-Zn5-012#6	106.31(13)	09-C19-010	125.2(4)	023-C53-C52	118.6(4)
021-Zn5-025	115.35(12)	09-C19-C20	118.6(4)	024-C53-C52	117.9(4)
012#6-Zn5-025	106.29(12)	010-C19-C20	116.1(4)	C47-C54-C52	120.0(4)
021-Zn5-03W	115.38(14)	C27-C20-C21	119.7(4)	018-C37-017	125.1(4)
012#6-Zn5-03W	110.15(16)	C27-C20-C19	121.3(4)	018-C37-C38	116.7(4)
025-Zn5-03W	103.03(13)	C21-C20-C19	119.0(4)	017-C37-C38	118.2(4)
C1-01-Zn1	126.8(3)	C22-C21-C20	121.0(4)	C37-017-Zn3#1	117.0(3)
C1-02-Eu1	154.0(3)	C24-C22-C21	118.0(4)	C37-018-Zn4#1	134.2(3)
C8-03-Zn4#4	125.3(3)	C24-C22-C23	121.7(5)		
C8-04-Zn3#4	130.7(3)	C21-C22-C23	120.2(5)		

Table S7. Selected bond distances (Å) and angles (deg) for **Zn-Tb**.

(Symmetry codes: #1=-x, -y, -z; #2=-x+1, -y, -z+1; #3=x-1, y-1, z-1; #4=-x+1, -y, -z; #5=-x+1, -y+1, -z+1; #6=-x, -y, -z+1; #7=x+1, y+1, z+1)

Tb1-05	2.295(2)	C38-C37	1.497(4)	C18-C17	1.386(4)
Tb1-019#1	2.3077(19)	C45-C43	1.391(4)	C12-C13	1.394(4)
Tb1-09	2.319(2)	02-C1	1.241(4)	C19-C20	1.495(4)
Tb1-02	2.329(2)	C4-C6	1.393(4)	C33-C31	1.392(5)
Tb1-023#1	2.335(2)	C4-C3	1.394(4)	C31-C32	1.511(5)
Tb1-016#2	2.391(2)	C4-C5	1.506(4)	C8-03	1.254(3)
Tb1-02W	2.508(2)	C54-C47	1.383(4)	C8-04	1.268(3)
Tb1-01W	2.534(2)	C54-C52	1.391(4)	03-Zn4#4	2.086(2)
Zn4-018	1.9780(19)	C2-C3	1.386(4)	04-Zn3#4	1.946(2)
Zn4-07#3	2.026(2)	C2-C9	1.387(4)	C41-019	1.255(3)
Zn4-025	2.040(2)	C2-C1	1.502(4)	C41-020	1.263(3)
Zn4-03#4	2.086(2)	010-C19	1.263(4)	020-Zn2#1	1.935(2)
Zn4-022	2.147(2)	C30-C31	1.385(5)	019-Tb1#1	2.3077(19)
Zn3-04#4	1.946(2)	C30-C29	1.387(4)	016-Tb1#2	2.391(2)
Zn3-017	1.954(2)	C6-C7	1.382(4)	C53-023	1.245(4)

Zn3-O14	1.974(2)	C39-C40	1.386(4)	C53-O24	1.284(4)
Zn3-O25	2.031(2)	C48-C49	1.387(4)	O24-Zn1#1	1.943(2)
Zn2-O10	1.930(2)	C48-C47	1.393(4)	O23-Tb1#1	2.335(2)
Zn2-O20#1	1.935(2)	C43-C42	1.384(4)	C20-C21	1.380(4)
Zn2-O15#2	1.974(2)	C43-C44	1.510(4)	C20-C27	1.384(4)
Zn2-O13	1.984(2)	C46-C47	1.492(4)	C27-C26	1.387(4)
Zn1-O24#1	1.943(2)	C51-C49	1.387(4)	C21-C22	1.387(5)
Zn1-O1	1.945(2)	C51-C52	1.389(4)	C26-C24	1.385(4)
Zn1-O6	1.955(2)	C29-C36	1.389(4)	C26-C25	1.506(4)
Zn1-O11#5	1.980(2)	C9-C7	1.385(4)	C22-C24	1.391(5)
Zn5-O21	1.935(2)	C49-C50	1.505(4)	C22-C23	1.511(5)
Zn5-O12#6	1.956(2)	C52-C53	1.486(4)	C25-O12	1.249(4)
Zn5-O25	1.965(2)	C36-C35	1.380(4)	C25-O11	1.263(4)
Zn5-O3W	2.022(3)	O5-C10	1.245(3)	O12-Zn5#6	1.956(2)
O17-C37	1.269(3)	O9-C19	1.239(4)	O11-Zn1#5	1.980(2)
O6-C10	1.272(4)	C40-C42	1.389(4)	O15-Zn2#2	1.974(2)
O18-C37	1.250(3)	C40-C41	1.496(4)	C13-C15	1.394(4)
O1-C1	1.274(4)	C7-C8	1.503(4)	C13-C14	1.501(4)
O21-C46	1.263(4)	C10-C11	1.490(4)	C17-C15	1.387(4)
O13-C28	1.255(4)	C34-O16	1.246(4)	C17-C16	1.493(4)
O14-C28	1.259(4)	C34-O15	1.257(4)	C16-O8	1.239(4)
O22-C46	1.252(4)	C34-C35	1.502(4)	C16-O7	1.278(4)
C28-C29	1.491(4)	C35-C33	1.381(4)	O7-Zn4#7	2.026(2)
C38-C45	1.385(4)	C11-C18	1.387(4)		
C38-C39	1.390(4)	C11-C12	1.387(4)		

O5-Tb1-O19#1	149.51(8)	Zn3-O25-Zn4	97.61(9)	O6-C10-C11	118.2(3)
O5-Tb1-O9	97.75(9)	C37-O18-Zn4	133.71(19)	O16-C34-O15	122.0(3)
O19#1-Tb1-O9	85.27(8)	C1-O1-Zn1	125.8(2)	O16-C34-C35	120.0(3)
O5-Tb1-O2	80.66(8)	C46-O21-Zn5	111.81(19)	O15-C34-C35	118.0(3)
O19#1-Tb1-O2	82.93(8)	C28-O13-Zn2	141.9(2)	C36-C35-C33	120.4(3)
O9-Tb1-O2	152.45(9)	C28-O14-Zn3	106.86(19)	C36-C35-C34	119.6(3)
O5-Tb1-O23#1	90.73(8)	C46-O22-Zn4	129.62(19)	C33-C35-C34	119.8(3)
O19#1-Tb1-O23#1	108.37(8)	O13-C28-O14	119.8(3)	C18-C11-C12	119.7(3)
O9-Tb1-O23#1	135.48(8)	O13-C28-C29	122.6(3)	C18-C11-C10	119.8(3)
O2-Tb1-O23#1	72.03(9)	O14-C28-C29	117.4(3)	C12-C11-C10	120.5(3)
O5-Tb1-O16#2	74.45(8)	C45-C38-C39	119.4(3)	C17-C18-C11	119.8(3)
O19#1-Tb1-O16#2	76.52(7)	C45-C38-C37	121.6(2)	C11-C12-C13	121.4(3)
O9-Tb1-O16#2	78.33(9)	C39-C38-C37	118.9(3)	O9-C19-O10	125.1(3)
O2-Tb1-O16#2	74.74(9)	C38-C45-C43	121.3(3)	O9-C19-C20	118.9(3)
O23#1-Tb1-O16#2	145.38(9)	C1-O2-Tb1	154.3(2)	O10-C19-C20	116.0(3)
O5-Tb1-O2W	140.24(9)	C6-C4-C3	117.8(3)	C35-C33-C31	120.9(3)
O19#1-Tb1-O2W	70.04(8)	C6-C4-C5	121.1(3)	C30-C31-C33	118.0(3)
O9-Tb1-O2W	76.27(9)	C3-C4-C5	121.1(3)	C30-C31-C32	120.8(3)
O2-Tb1-O2W	122.03(9)	C47-C54-C52	119.6(3)	C33-C31-C32	121.2(3)
O23#1-Tb1-O2W	69.79(8)	C3-C2-C9	119.5(3)	O3-C8-O4	126.5(3)

O16#2-Tb1-O2W	139.18(8)	C3-C2-C1	121.5(3)	O3-C8-C7	118.6(2)
O5-Tb1-O1W	70.16(8)	C9-C2-C1	118.9(3)	O4-C8-C7	114.9(3)
O19#1-Tb1-O1W	137.61(8)	C19-O10-Zn2	128.9(2)	C8-O3-Zn4#4	125.18(18)
O9-Tb1-O1W	69.90(8)	C2-C3-C4	121.3(3)	C8-O4-Zn3#4	130.24(19)
O2-Tb1-O1W	132.96(8)	O18-C37-O17	124.8(3)	O19-C41-O20	124.4(3)
O23#1-Tb1-O1W	72.30(8)	O18-C37-C38	116.8(2)	O19-C41-C40	118.3(2)
O16#2-Tb1-O1W	127.72(8)	O17-C37-C38	118.4(3)	O20-C41-C40	117.3(2)
O2W-Tb1-O1W	70.95(9)	C31-C30-C29	121.5(3)	C41-O20-Zn2#1	122.03(18)
O18-Zn4-O7#3	140.53(8)	C7-C6-C4	121.6(3)	C41-O19-Tb1#1	152.19(19)
O18-Zn4-O25	105.97(9)	C40-C39-C38	120.0(3)	C34-O16-Tb1#2	154.2(2)
O7#3-Zn4-O25	111.81(9)	C49-C48-C47	121.1(3)	O23-C53-O24	123.0(3)
O18-Zn4-O3#4	91.86(9)	O2-C1-O1	124.8(3)	O23-C53-C52	119.2(3)
O7#3-Zn4-O3#4	98.15(8)	O2-C1-C2	118.1(3)	O24-C53-C52	117.8(3)
O25-Zn4-O3#4	91.39(9)	O1-C1-C2	117.1(3)	C53-O24-Zn1#1	122.5(2)
O18-Zn4-O22	85.05(8)	C42-C43-C45	118.4(3)	C53-O23-Tb1#1	136.0(2)
O7#3-Zn4-O22	87.36(8)	C42-C43-C44	120.8(3)	C21-C20-C27	119.4(3)
O25-Zn4-O22	84.71(9)	C45-C43-C44	120.8(3)	C21-C20-C19	119.4(3)
O3#4-Zn4-O22	174.15(8)	O22-C46-O21	123.7(3)	C27-C20-C19	121.1(3)
O4#4-Zn3-O17	111.83(9)	O22-C46-C47	118.6(3)	C20-C27-C26	119.8(3)
O4#4-Zn3-O14	126.13(9)	O21-C46-C47	117.7(3)	C20-C21-C22	121.9(3)
O17-Zn3-O14	111.98(9)	C49-C51-C52	121.7(3)	C24-C26-C27	120.1(3)
O4#4-Zn3-O25	96.61(9)	C30-C29-C36	119.5(3)	C24-C26-C25	119.3(3)
O17-Zn3-O25	110.96(9)	C30-C29-C28	119.1(3)	C27-C26-C25	120.6(3)
O14-Zn3-O25	95.61(9)	C36-C29-C28	121.2(3)	C21-C22-C24	118.0(3)
O10-Zn2-O20#1	118.33(11)	C54-C47-C48	120.0(3)	C21-C22-C23	120.8(3)
O10-Zn2-O15#2	110.46(11)	C54-C47-C46	118.8(3)	C24-C22-C23	121.2(3)
O20#1-Zn2-O15#2	124.34(10)	C48-C47-C46	121.2(3)	O12-C25-O11	124.7(3)
O10-Zn2-O13	96.09(10)	C7-C9-C2	120.3(3)	O12-C25-C26	115.6(3)
O20#1-Zn2-O13	98.64(9)	C51-C49-C48	118.0(3)	O11-C25-C26	119.7(3)
O15#2-Zn2-O13	101.30(10)	C51-C49-C50	120.3(3)	C26-C24-C22	120.8(3)
O24#1-Zn1-O1	114.56(10)	C48-C49-C50	121.6(3)	C25-O12-Zn5#6	128.4(2)
O24#1-Zn1-O6	111.71(10)	C51-C52-C54	119.4(3)	C25-O11-Zn1#5	133.4(2)
O1-Zn1-O6	119.67(10)	C51-C52-C53	120.8(3)	C34-O15-Zn2#2	105.05(19)
O24#1-Zn1-O11#5	99.36(10)	C54-C52-C53	119.7(3)	C15-C13-C12	117.8(3)
O1-Zn1-O11#5	106.24(9)	C35-C36-C29	119.4(3)	C15-C13-C14	121.4(3)
O6-Zn1-O11#5	102.07(9)	C10-O5-Tb1	171.1(2)	C12-C13-C14	120.8(3)
O21-Zn5-O12#6	105.94(10)	C19-O9-Tb1	149.9(2)	C18-C17-C15	119.9(3)
O21-Zn5-O25	114.64(9)	C39-C40-C42	119.6(3)	C18-C17-C16	119.1(3)
O12#6-Zn5-O25	106.11(9)	C39-C40-C41	119.3(3)	C15-C17-C16	120.9(3)
O21-Zn5-O3W	117.62(11)	C42-C40-C41	121.0(3)	O8-C16-O7	121.2(3)
O12#6-Zn5-O3W	108.25(12)	C6-C7-C9	119.5(3)	O8-C16-C17	119.9(3)
O25-Zn5-O3W	103.66(11)	C6-C7-C8	121.3(3)	O7-C16-C17	118.8(3)
C37-O17-Zn3	117.09(19)	C9-C7-C8	119.2(3)	C17-C15-C13	121.2(3)
C10-O6-Zn1	109.65(18)	C43-C42-C40	121.2(3)	C16-O7-Zn4#7	102.22(19)
Zn5-O25-Zn3	114.82(11)	O5-C10-O6	121.8(3)		
Zn5-O25-Zn4	116.04(11)	O5-C10-C11	120.0(3)		

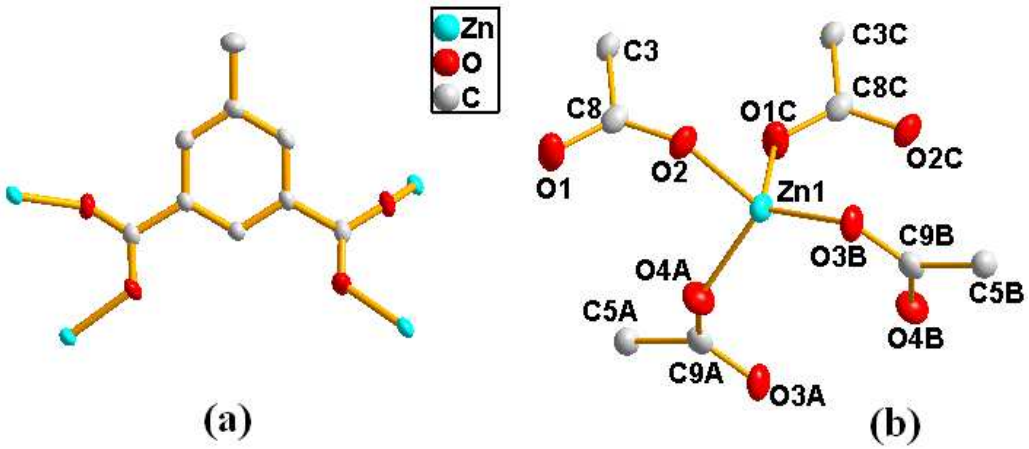

Figure S1. Coordination environments of the mip ligand and Zn atom are shown as thermal ellipsoids (50% probability level) in **Zn-Zn**. Hydrogen atoms are omitted for clarity. Symmetry codes: A (-x, -0.5+y,0.5-z), B (1+x, 0.5-y,0.5+z), C(1+x, y, z)

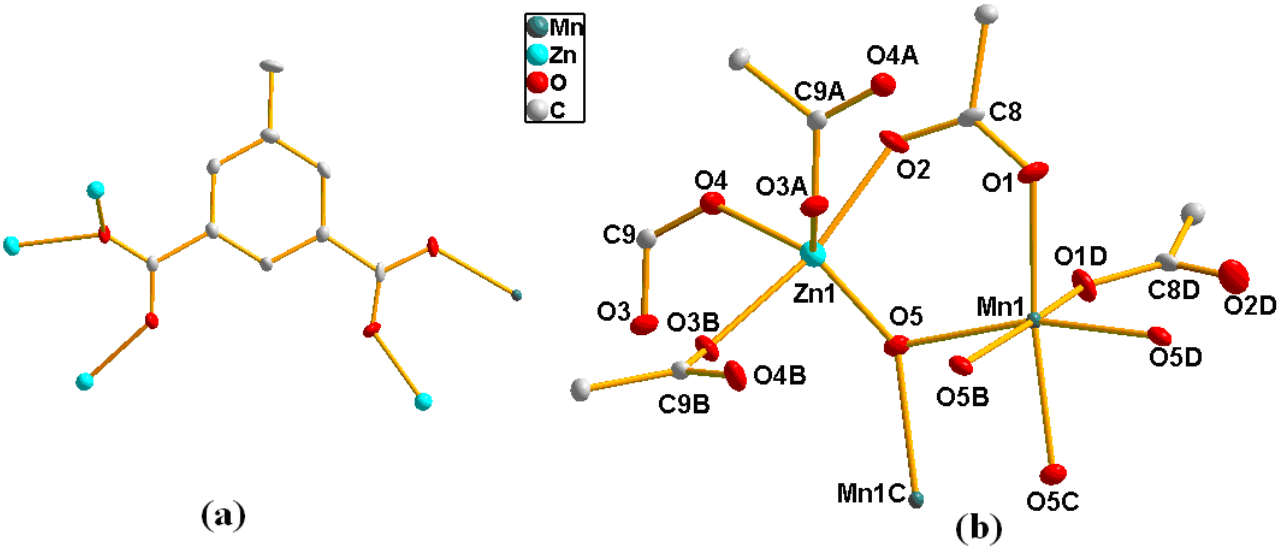

Figure S2. Coordination environments of the mip ligand, Zn and Mn atoms are shown as thermal ellipsoids (50% probability level) in **Zn-Mn**. Hydrogen atoms are omitted for clarity. Symmetry codes: A (x, y,-1+z), B (x, 2-y,-0.5+z), C (2-x, 2-y,1-z), D (2-x, y,0.5-z)

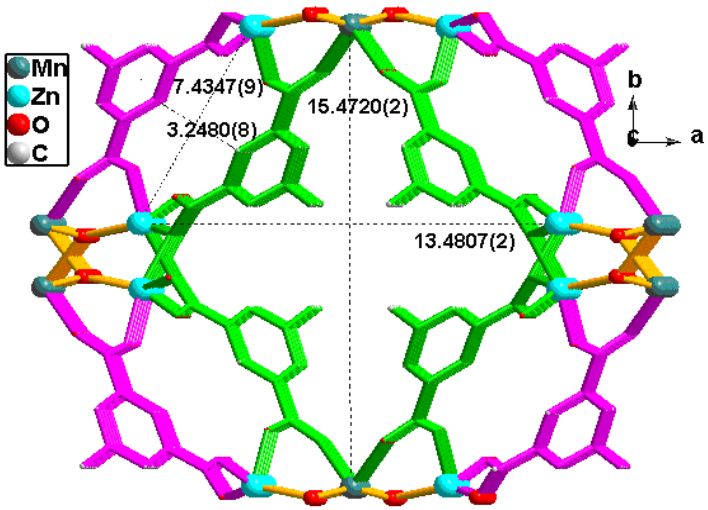

Figure S3. 3D hetero-MOFs featuring window-shaped helical channels with cross section dimensions of 15.4720(2)×13.4807(2) and 7.4347(9)×3.2480(8) Å in *ab* plane for **Zn-Mn**.

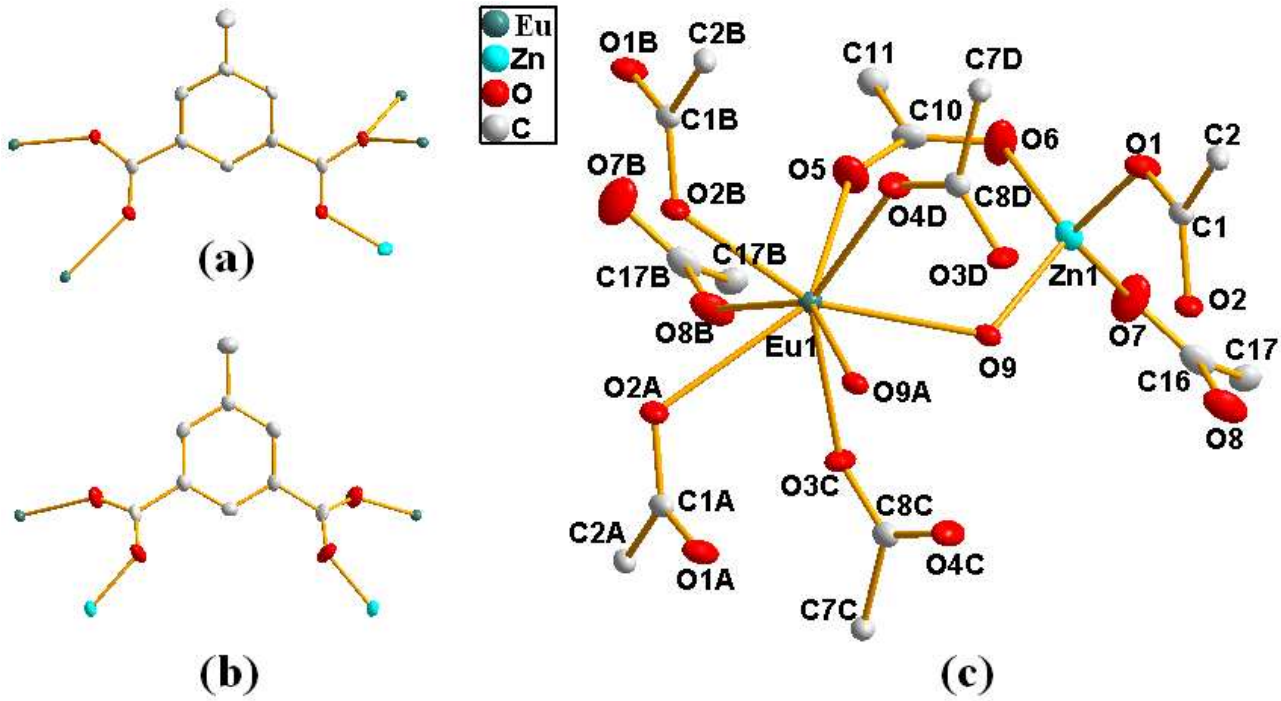

Figure S4. Coordination environments of the mip ligand, Zn and Eu atoms are shown as thermal ellipsoids (50% probability level) in **Zn-Eu1**. Hydrogen atoms are omitted for clarity. Symmetry codes: A (-x, 1-y,-z), B (-1+x, y, z), C (0.5-x, 1-y,-0.5+z), D (-0.5+x, y,0.5-z).

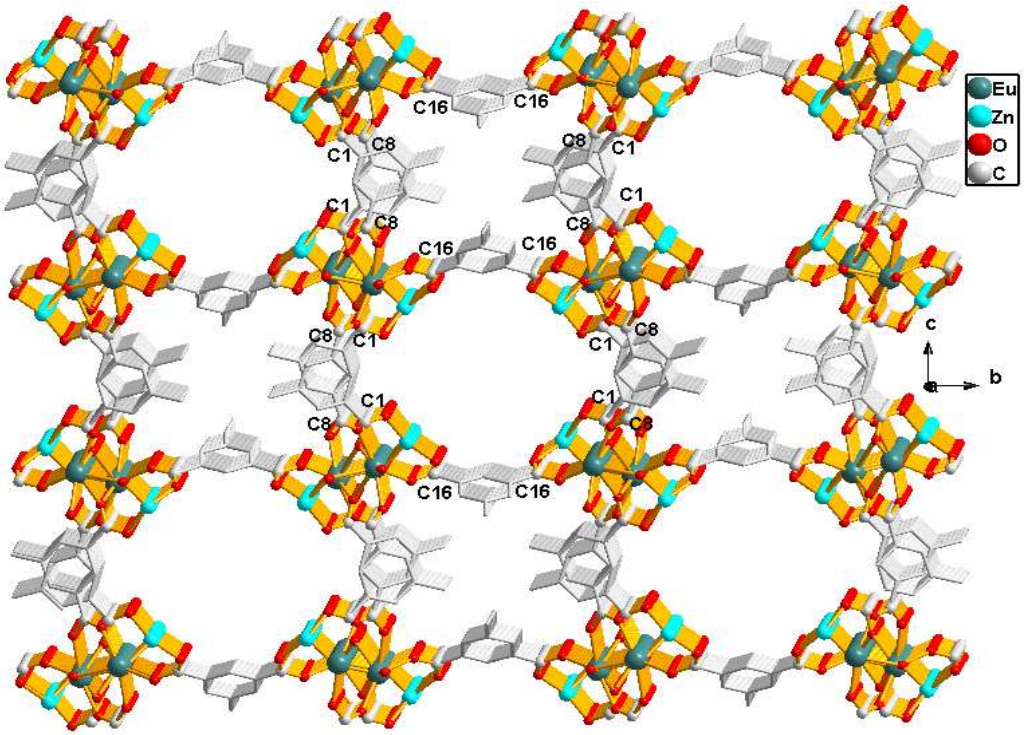

Figure S5. 3D framework for **Zn-Eu1.**

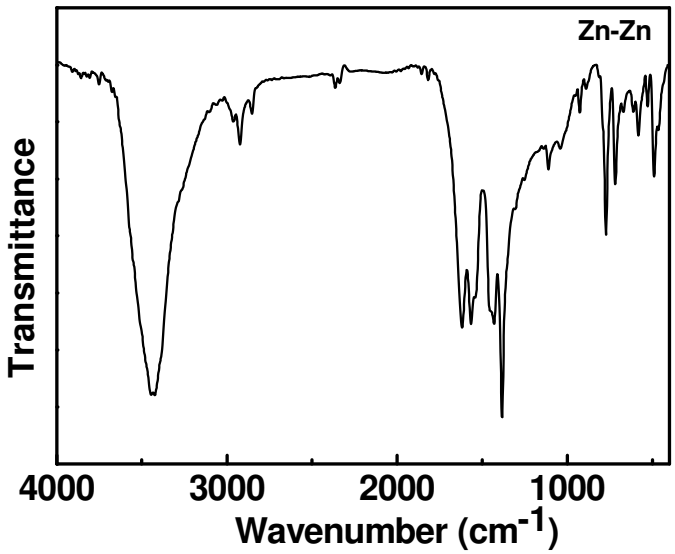

Figure S6. FT-IR spectrum for compound **Zn-Zn.**

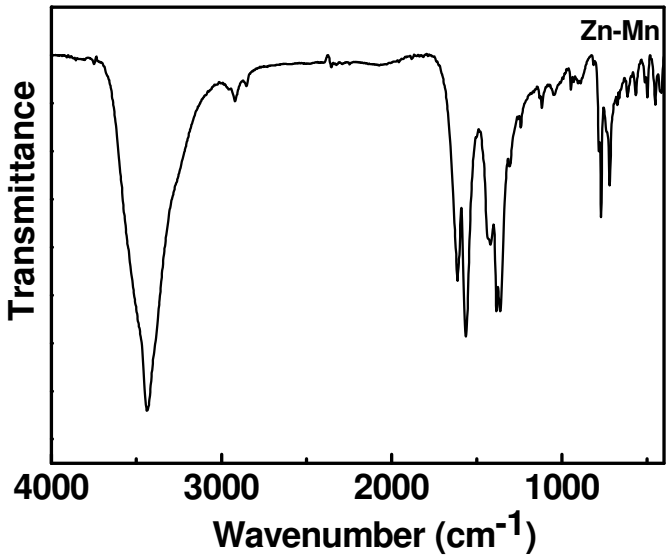

Figure S7. FT-IR spectrum for compound **Zn-Mn.**

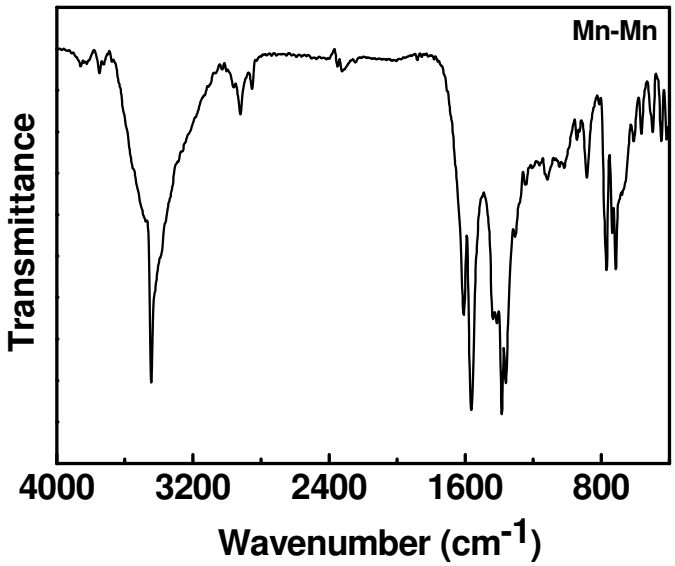

Figure S8. FT-IR spectrum for compound **Mn-Mn.**

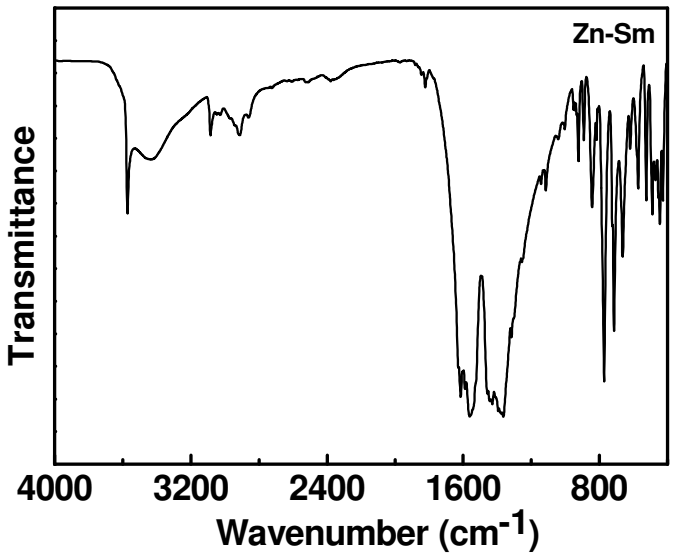

Figure S9. FT-IR spectrum for compound **Zn-Sm.**

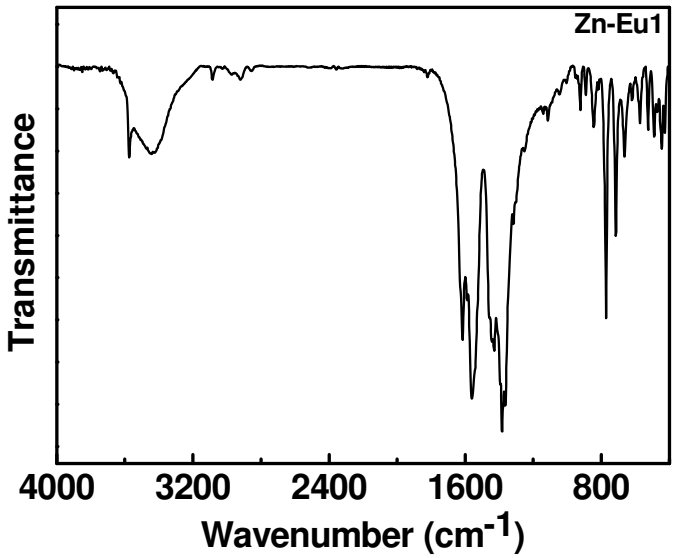

Figure S10. FT-IR spectrum for compound **Zn-Eu1.**

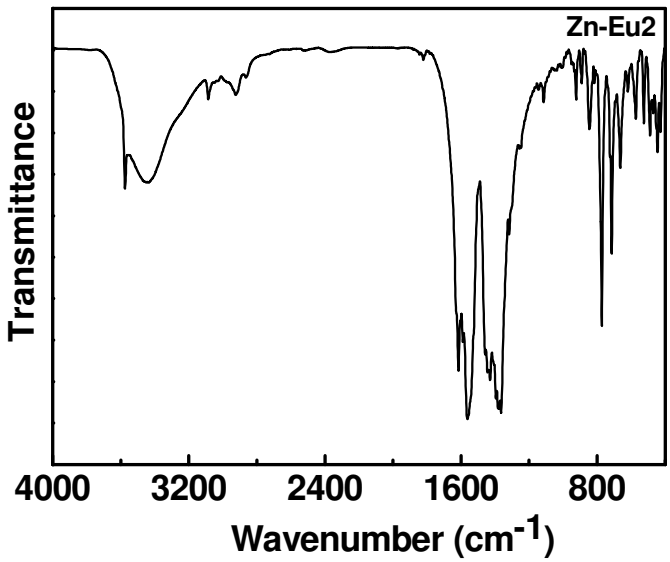

Figure S11. FT-IR spectrum for compound **Zn-Eu2.**

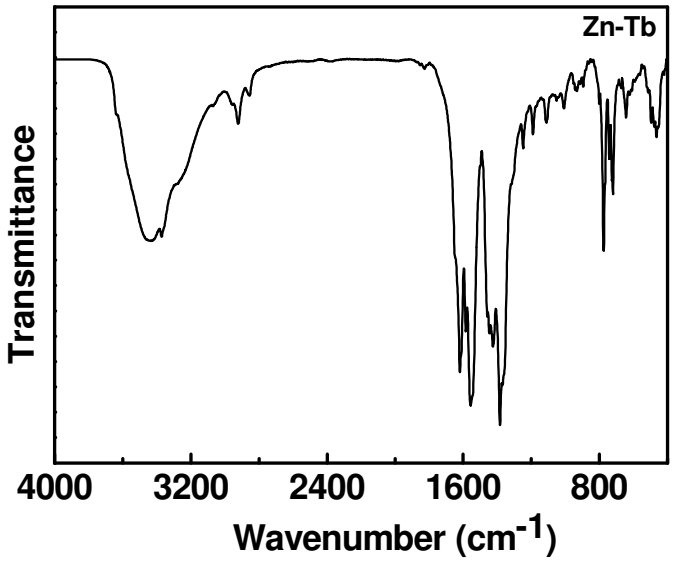

Figure S12. FT-IR spectrum for compound **Zn-Tb.**

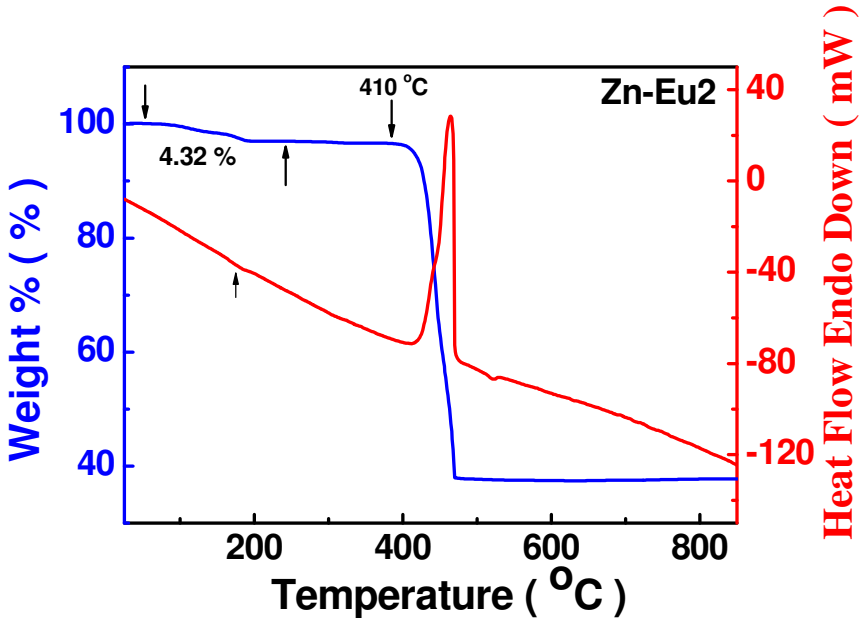

Figure S13. TG-DTA for compound **Zn-Eu2.**

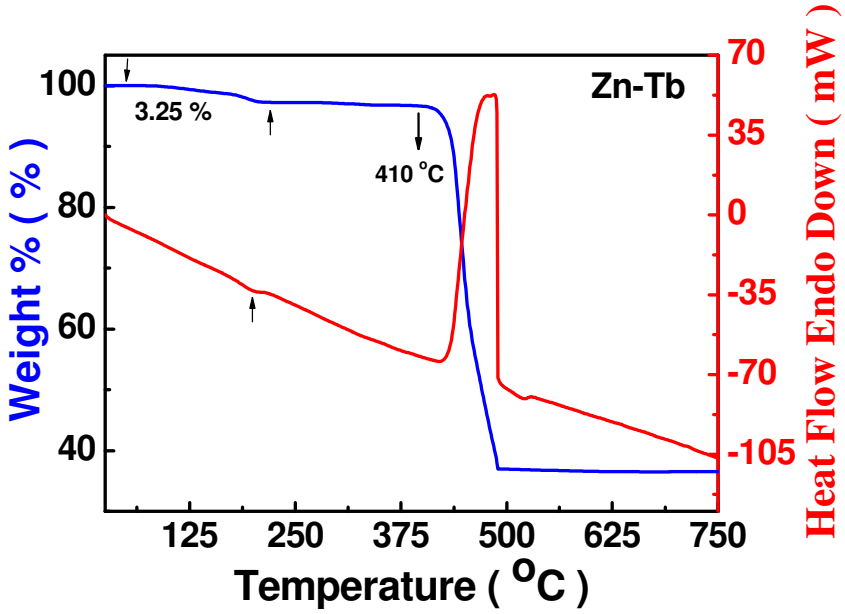

Figure S14. TG-DTA for compound **Zn-Tb.**

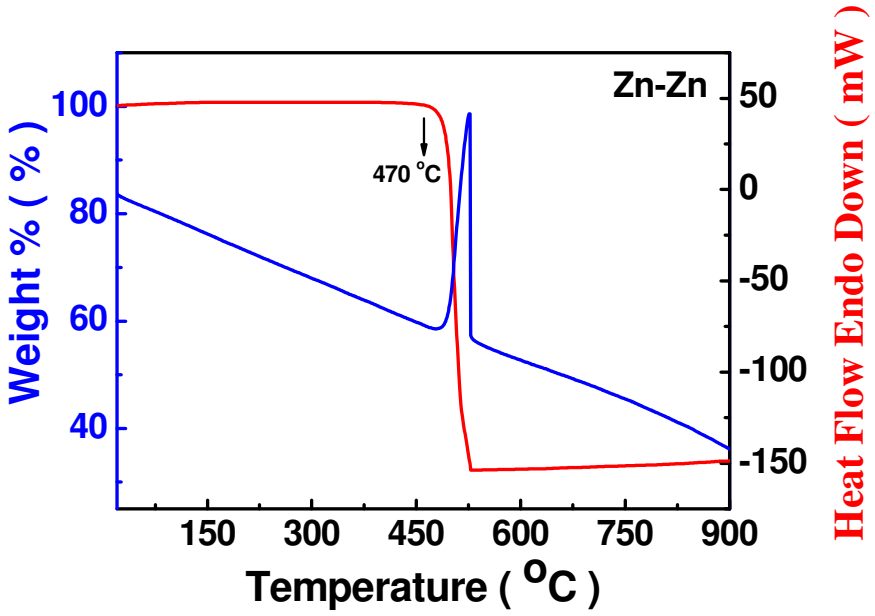

Figure S15. TG-DTA for compound **Zn-Zn.**

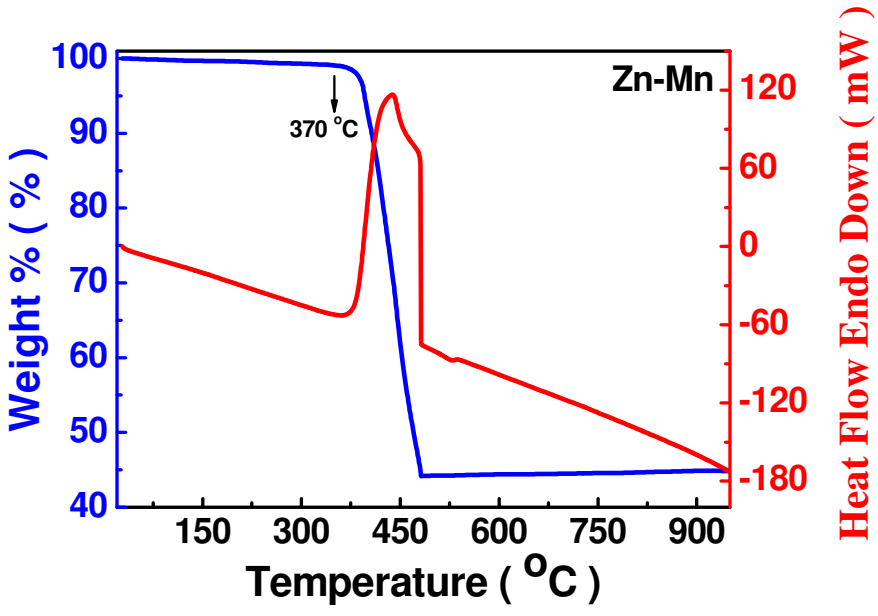

Figure S16. TG-DTA for compound **Zn-Mn.**

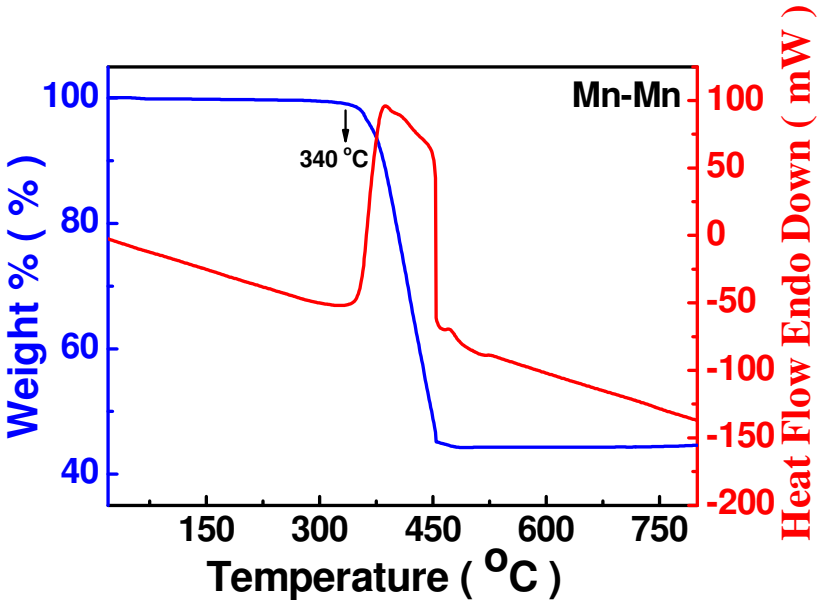

Figure S17. TG-DTA for compound M**n-Mn.**

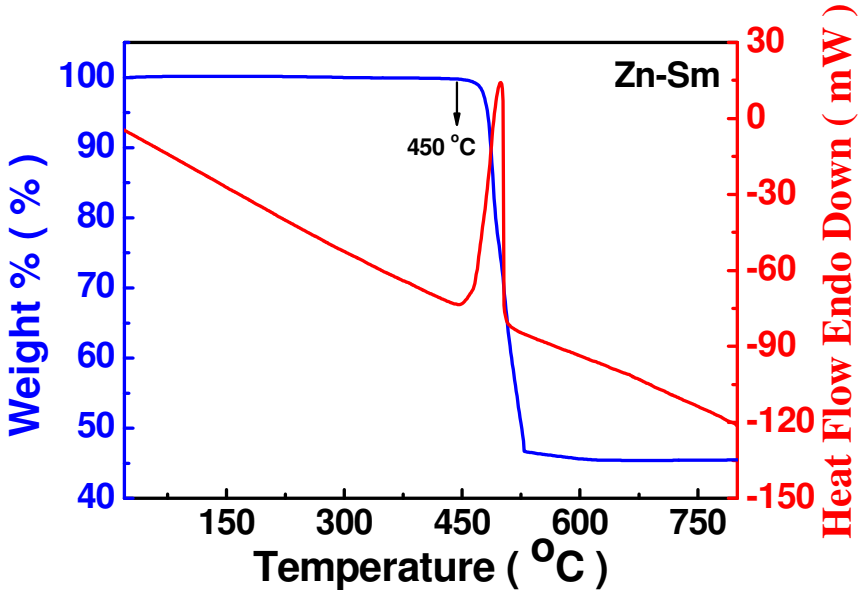

Figure S18. TG-DTA for compound **Zn-Sm.**

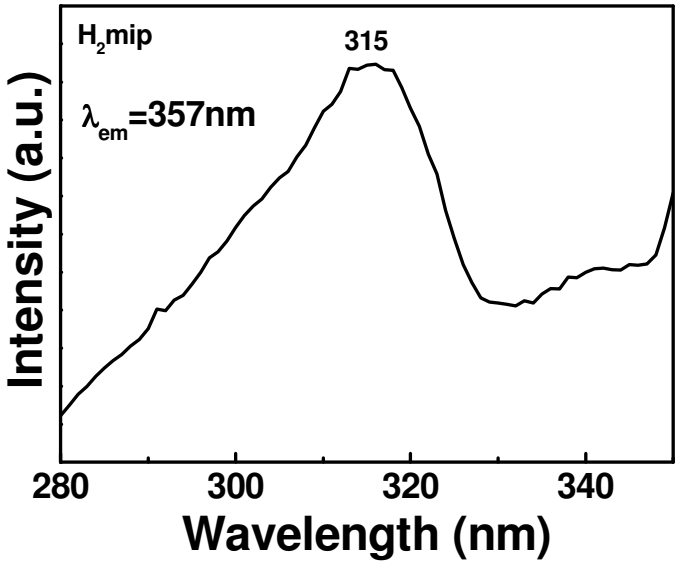

Figure S19. The excitation spectrum for H_2mip**.**

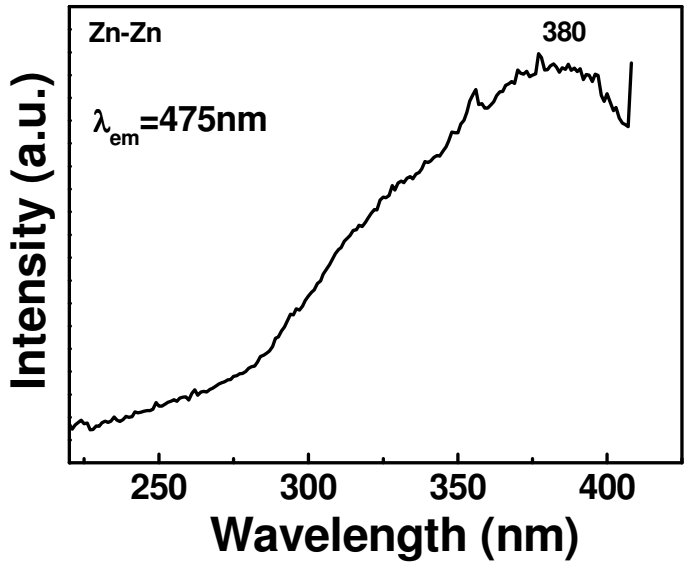

Figure S20. The excitation spectrum for **Zn-Zn.**

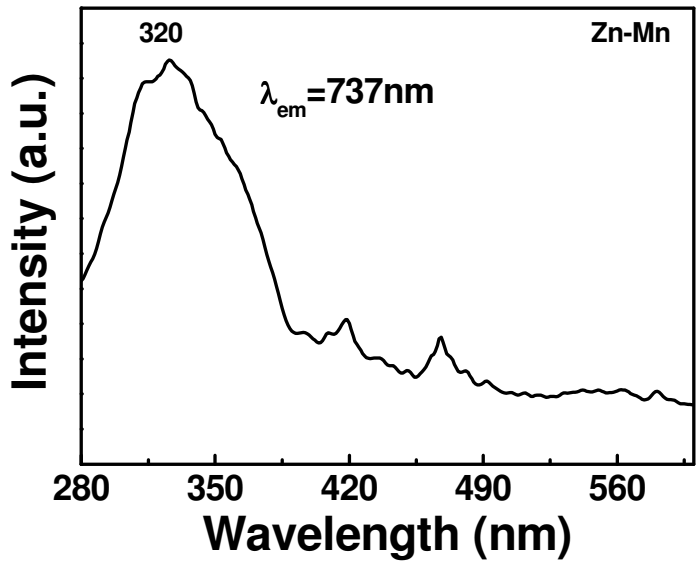

Figure S21. The excitation spectrum for **Zn-Mn.**

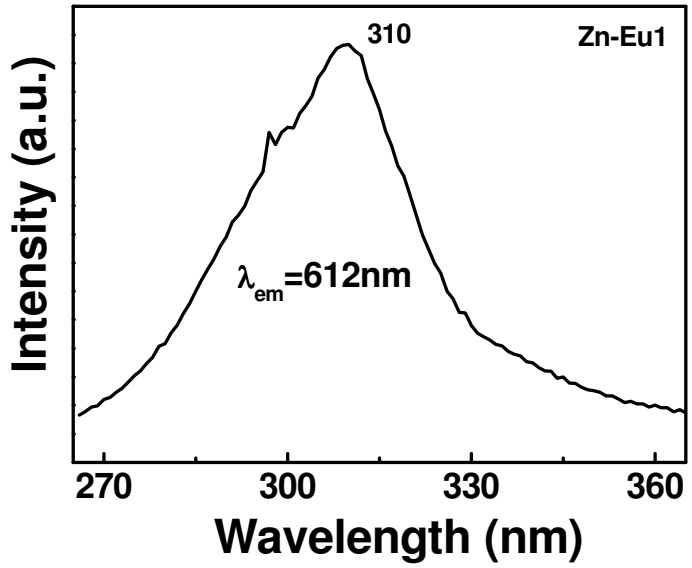

Figure S22. The excitation spectrum for **Zn-Eu1.**

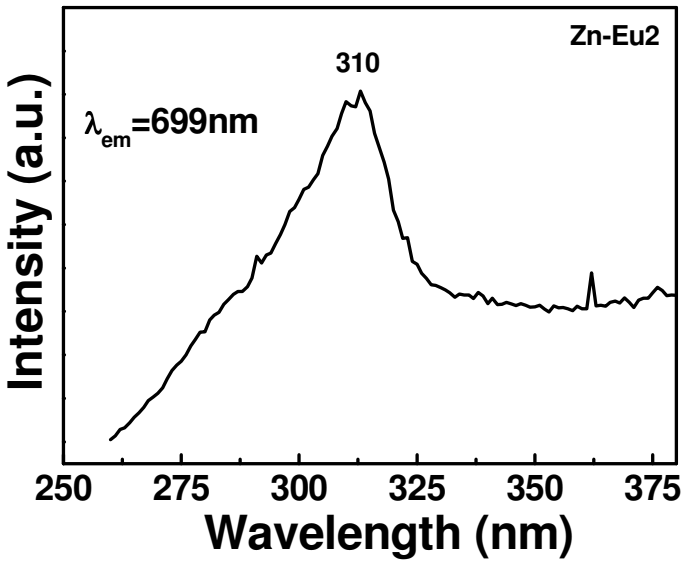

Figure S23. The excitation spectrum for **Zn-Eu2.**

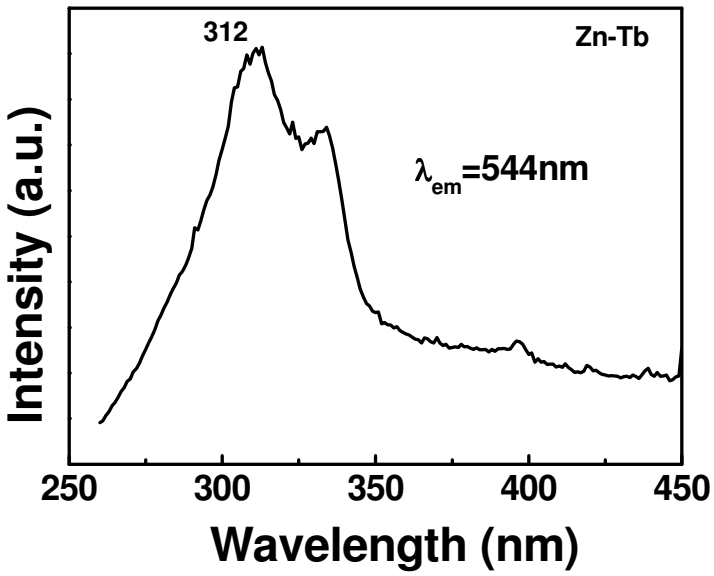

Figure S24. The excitation spectrum for **Zn-Tb.**

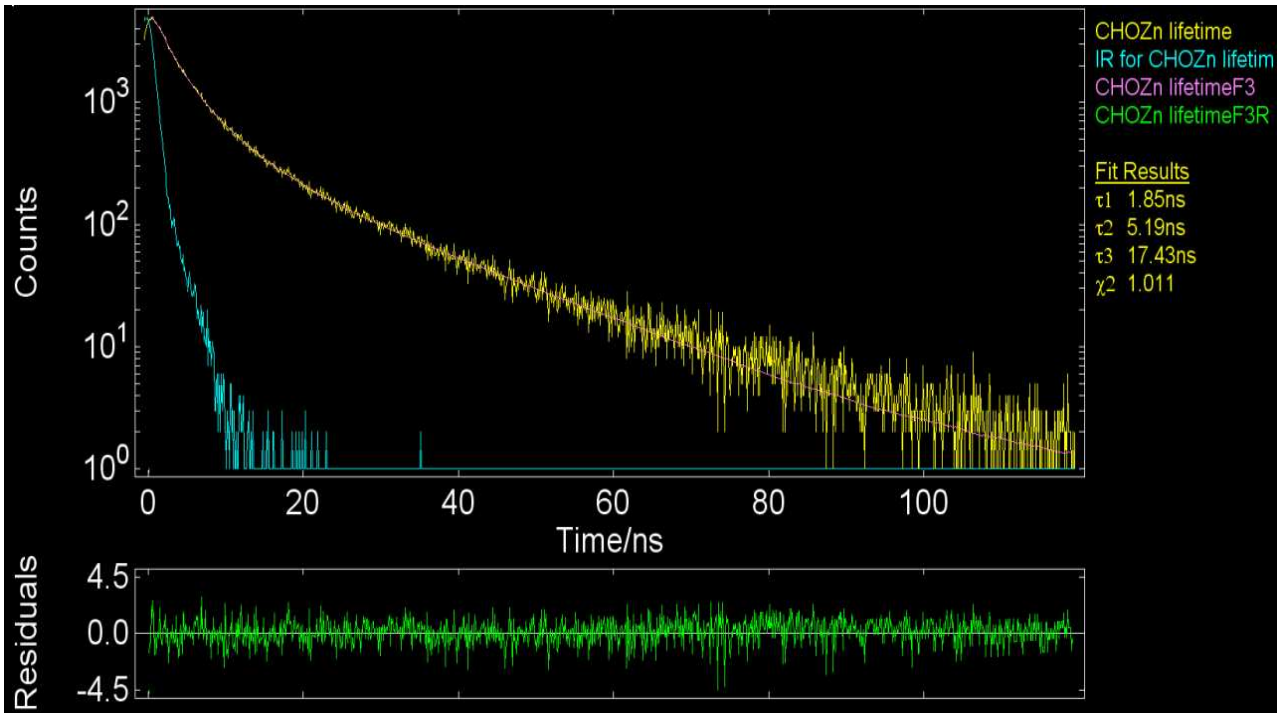

Figure S25. luminescent lifetime decay profiles of **Zn-Zn**

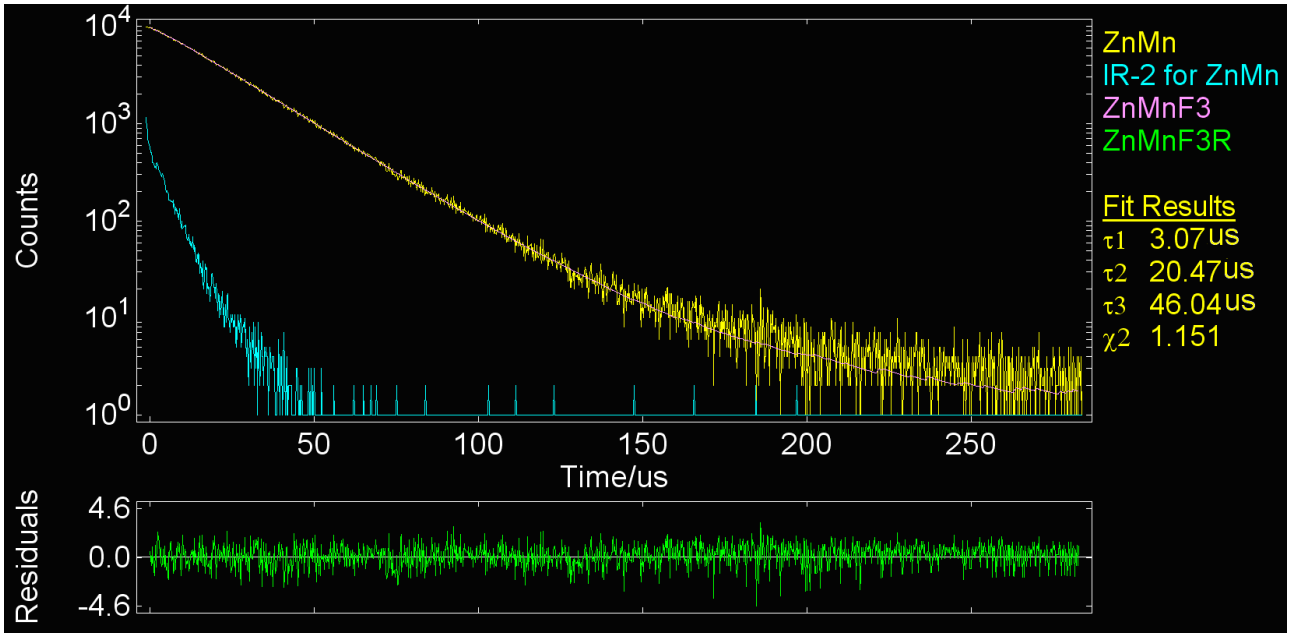

Figure S26. luminescent lifetime decay profiles of **Zn-Mn**

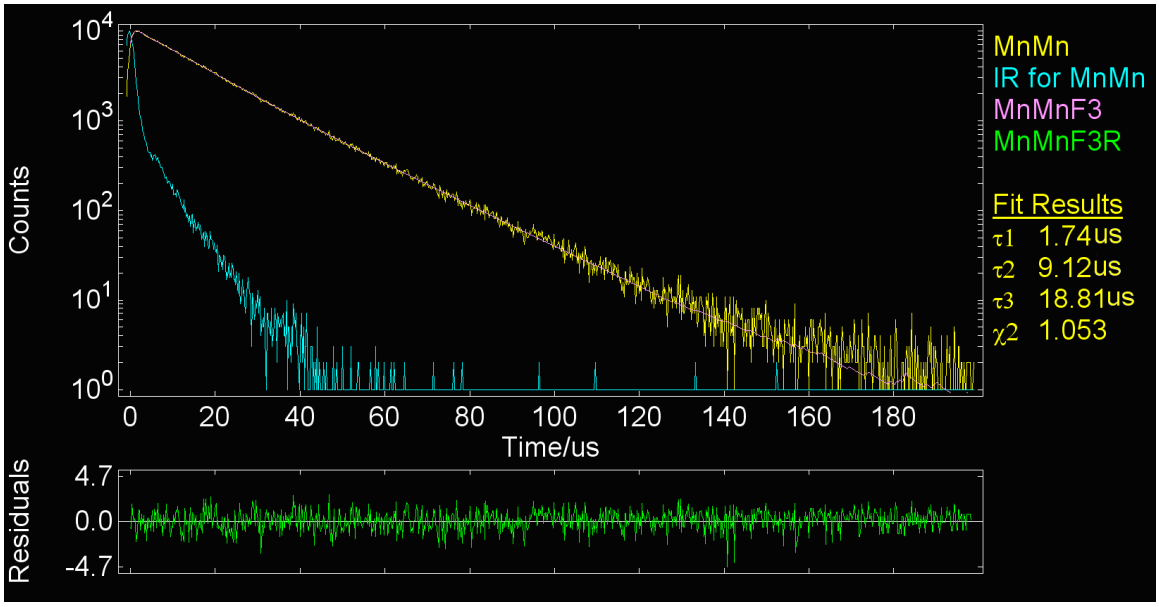

Figure S27. luminescent lifetime decay profiles of **Mn-Mn**

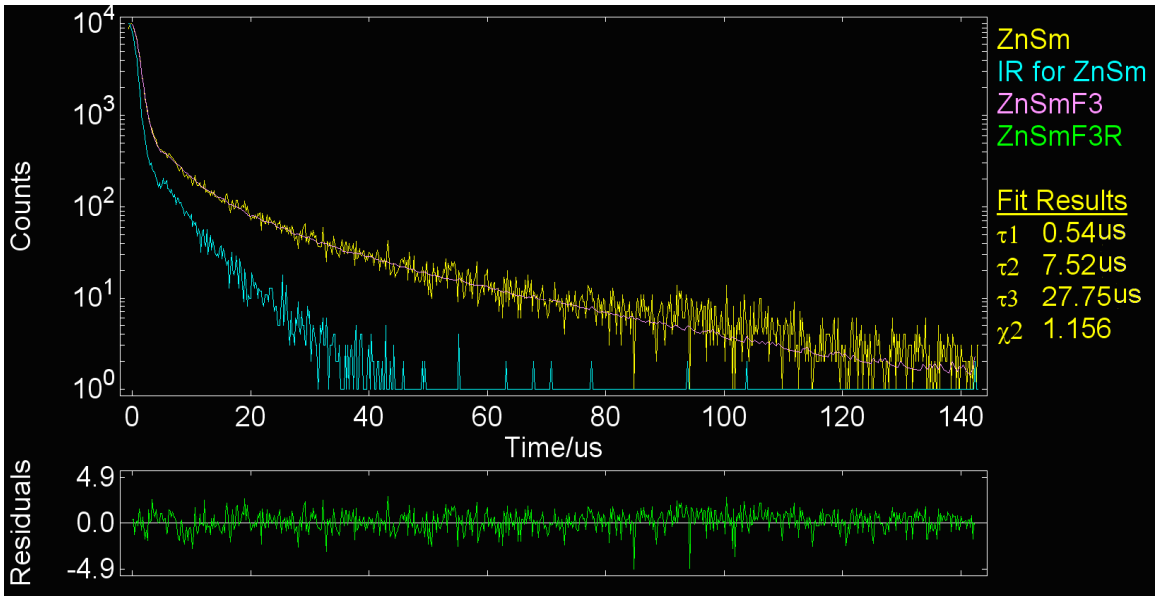

Figure S28. luminescent lifetime decay profiles of **Zn-Sm**

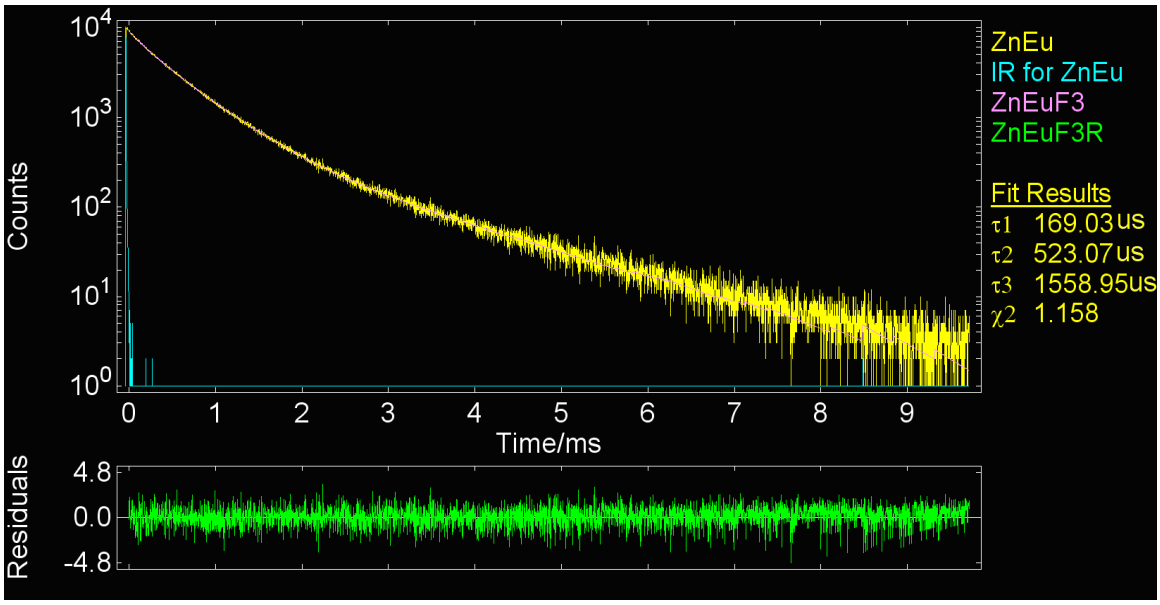

Figure S29. luminescent lifetime decay profiles of **Zn-Eu1**

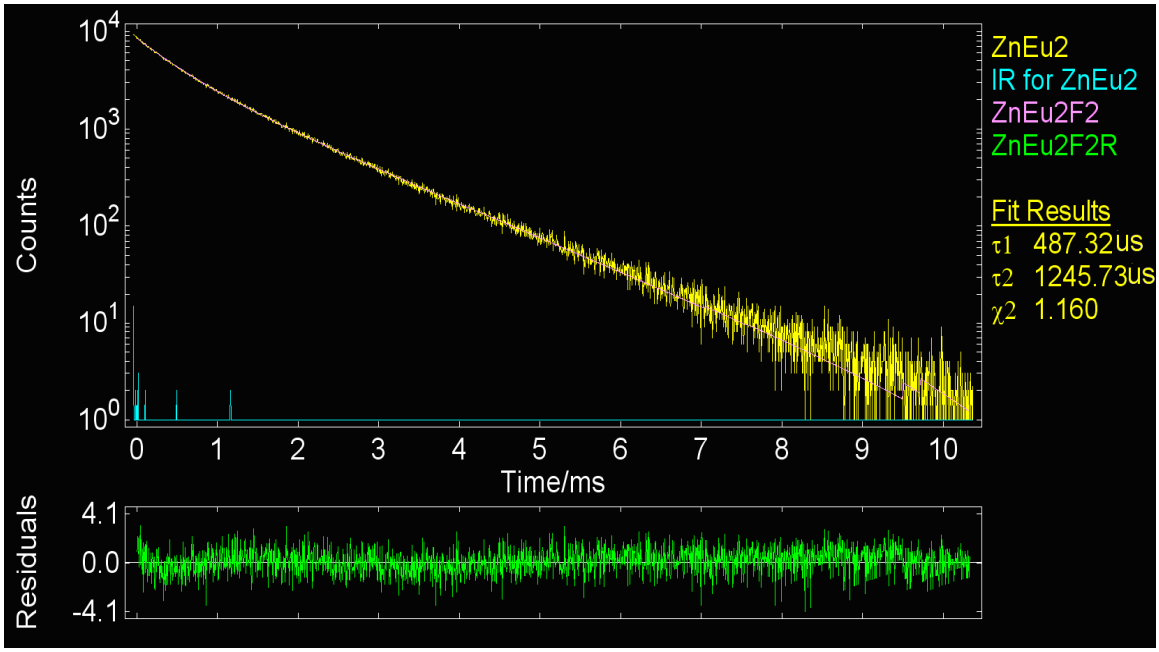

Figure S30. luminescent lifetime decay profiles of **Zn-Eu2**

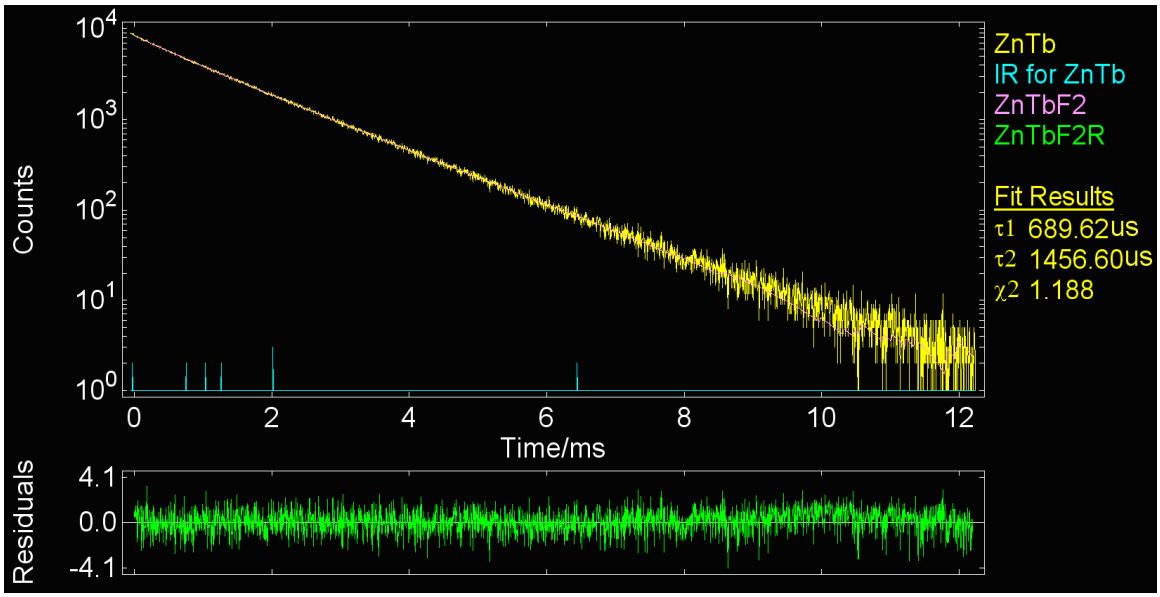

Figure S31. luminescent lifetime decay profiles of **Zn-Tb**

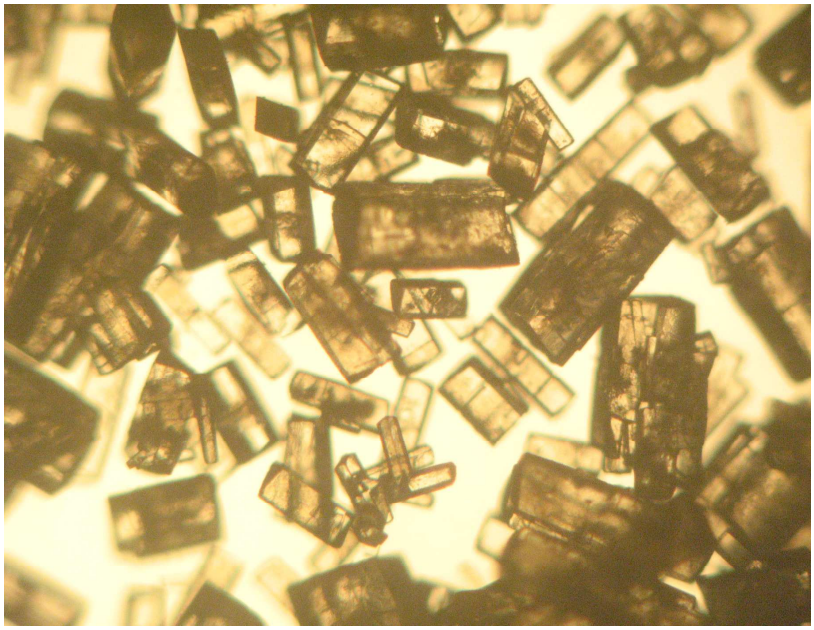

Figure S32. Micrographs of the fawn-colored prism crystals for **Zn-Mn** (enlarging 4 × 10 times on optical microscope)