

Electronic Supplementary Information

Influence of Anionic Sulfonate-Containing and Nitrogen-Containing Mixed-Ligands on the Structures of Silver Coordination Polymers

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Table S1. Hydrogen-bond Geometries for Compounds **1–9** (Å,°)

D–H···A	D–H [Å]	H···A [Å]	D···A [Å]	<D–H···A [°]
Compound 1				
N(1)–H(2N)...O(1)#3	0.84(2)	2.12(2)	2.944(4)	165(3)
N(1)–H(1N)...O(2)#4	0.83(2)	2.17(3)	2.971(4)	161(4)
O(1W)–H(1B)...O(1)#5	0.90(2)	2.40(3)	3.134(4)	139(3)
O(1W)–H(1A)...O(2)#6	0.86(2)	2.22(2)	3.066(4)	168(4)
Compound 3				
O(1W)–H(1A)...O(2)	0.80(6)	2.07(7)	2.815(7)	154(11)
O(1W)–H(1B)...O(3)#4	0.78(6)	2.16(6)	2.906(7)	160(12)
O(2W)–H(2B)...O(3)#5	0.77(6)	2.04(6)	2.796(6)	170(11)
O(2W)–H(2A)...O(1W)#6	0.79(6)	1.84(6)	2.623(8)	170(12)
Compound 4				
O(1W)–H(1A)...O(5)	0.81(3)	1.96(3)	2.762(5)	176(7)
O(1W)–H(1B)...O(2)#3	0.79(3)	2.07(3)	2.862(5)	178(7)
Compound 5				
O(1W)–H(1B)...O(7)#4	0.92(4)	2.21(5)	3.104(4)	164(7)
O(2W)–H(2A)...O(7)	0.85(3)	2.32(3)	3.148(4)	165(4)
O(2W)–H(2B)...O(3)#13	0.83(4)	2.09(4)	2.898(3)	164(5)
Compound 6				
O(1W)–H(1A)...O(4)#1	0.93(7)	1.88(7)	2.807(7)	174(11)
O(1W)–H(1B)...O(2W)#1	0.88(7)	1.95(8)	2.805(10)	161(12)
O(2W)–H(2A)...O(1W)#2	0.85(7)	2.14(9)	2.919(9)	153(13)
O(2W)–H(2B)...O(2)	0.80(8)	2.18(8)	2.970(10)	173(14)
O(3W)–H(3A)...O(8)#1	0.97(7)	2.47(12)	3.110(10)	123(10)
O(3W)–H(3B)...O(9)#3	0.82(7)	2.47(9)	2.927(10)	116(9)
O(4W)–H(4B)...O(5)#1	0.74(7)	2.18(9)	2.850(9)	151(16)
O(4W)–H(4A)...O(3W)	0.95(7)	1.91(7)	2.839(12)	166(12)
O(5W)–H(5B)...O(1W)	0.98(7)	2.01(7)	2.932(11)	156(11)
Compound 7				
O(1W)–H(1A)...O(5)#3	0.88(4)	2.15(6)	2.965(7)	155(9)
O(1W)–H(1B)...O(3)#4	0.83(4)	2.15(6)	2.900(8)	152(10)
O(2W)–H(2B)...O(4)#5	0.96(5)	2.17(5)	3.089(9)	158(9)
O(2W)–H(2A)...O(3W)#3	0.90(5)	1.92(6)	2.719(8)	148(9)
O(3W)–H(3A)...O(1)	0.90(4)	2.05(6)	2.823(7)	144(8)
O(3W)–H(3B)...O(6W)#6	0.86(4)	1.84(5)	2.664(8)	161(9)
O(4W)–H(4B)...O(4)	0.98(4)	1.77(5)	2.734(6)	170(10)
O(4W)–H(4A)...O(5W)	0.92(4)	2.00(7)	2.720(9)	134(9)

O(5W)-H(5B)...O(1)	0.96(4)	1.99(7)	2.834(8)	145(9)
O(5W)-H(5A)...O(7)#1	0.81(4)	2.29(8)	2.907(7)	134(10)
O(6W)-H(6A)...O(9)	0.81(4)	1.93(6)	2.688(6)	155(11)
O(6W)-H(6B)...O(4W)#2	0.82(5)	1.96(5)	2.737(8)	158(10)
O(7W)-H(7B)...O(5)#5	0.93(5)	2.35(11)	2.904(8)	118(9)
O(7W)-H(7A)...O(2W)	0.82(5)	2.17(9)	2.767(9)	129(10)

Compound 9

O(3W)-H(3B)...O(6)#7	0.84(5)	2.32(7)	3.095(13)	154(8)
O(3W)-H(3B)...O(5)#8	0.84(5)	2.55(8)	2.926(11)	109(7)
O(2W)-H(2B)...O(4)#1	0.92(5)	1.80(6)	2.670(10)	157(8)
O(2W)-H(2B)...O(7)#1	0.92(5)	2.37(9)	3.063(11)	131(8)
O(2W)-H(2A)...O(3W)	0.97(5)	2.31(5)	2.936(8)	121(5)

[a] Symmetry operations: for **1**: #3 $-x+1, y+1/2, -z+3/2$; #4 $-x, y+1/2, -z+3/2$; #5 $x, -y-1/2, z-1/2$; #6 $-x, y-1/2, -z+3/2$. for **3**: #4 $x+1, y, z$; #5 $-x, -y+2, -z+1$; #6 $x-1, y, z+1$; for **4**: #3 $x, y-1$; For **5**: #4 $-x, -y+1, -z+1$; #13 $-x+1, -y+1, -z+1$; for **6**: #1 $x+1, y, z$; #2 $-x+1, -y, -z+1$; #3 $-x+1, -y+1, -z$; for **7**: #1 $x, y-1, z$; #2 $x, y+1, z$; #3 $x+1/2, -y, z+1/2$; #4 $x+1, y-1, z$; #5 $x, y, z+1$; #6 $x-1/2, -y+1, z+1/2$; **9**: #1 $-x+1/2, y+1/2, z$; #7 $x-1/2, y+1/2, z$; #8 $-x+1/2, -y+1/2, z+1/2$.

Table S2. Selected Bond Lengths [Å] and Angles [deg] for **1–9**.^[a]

Compound 1			
Ag(1)-O(1W)	2.142(3)	Ag(1)-N(1)	2.209(3)
Ag(1)-O(3)#1	2.550(2)	O(1W)-Ag(1)-N(1)	162.35(10)
O(1W)-Ag(1)-O(3)#1	98.46(10)	N(1)-Ag(1)-O(3)#1	98.14(9)
Compound 2			
Ag(1)-N(3)#1	2.377(3)	Ag(1)-N(3)	2.377(3)
Ag(1)-N(2)	2.455(3)	Ag(1)-O(2)#1	2.608(3)
Ag(1)-O(2)	2.608(3)	N(3)#1-Ag(1)-N(3)	120.29(12)
N(3)#1-Ag(1)-N(2)	108.78(6)	N(3)-Ag(1)-N(2)	108.78(6)
N(3)#1-Ag(1)-O(2)#1	136.83(8)	N(3)-Ag(1)-O(2)#1	85.94(8)
N(2)-Ag(1)-O(2)#1	91.34(9)	N(3)#1-Ag(1)-O(2)	85.94(8)
N(3)-Ag(1)-O(2)	136.83(8)	N(2)-Ag(1)-O(2)	91.34(9)
O(2)#1-Ag(1)-O(2)	54.94(11)		
Compound 3			
Ag(1)-O(1)#1	2.240(4)	Ag(1)-N(1)	2.279(4)

Ag(1)-O(4)	2.513(5)	Ag(1)-O(1)#2	2.567(4)
O(1)#1-Ag(1)-N(1)	155.84(16)	O(1)#1-Ag(1)-O(4)	135.76(14)
N(1)-Ag(1)-O(4)	68.24(15)	O(1)#1-Ag(1)-O(1)#2	79.99(13)
N(1)-Ag(1)-O(1)#2	105.19(13)	O(4)-Ag(1)-O(1)#2	92.28(13)

Compound 4

Ag(1)-N(3)	2.101(3)	Ag(2)-N(9)#1	2.100(3)
Ag(2)-N(6)	2.103(4)	Ag(1)-O(1)	2.637(3)
N(9)#1-Ag(2)-N(6)	166.67(15)	N(2)-Ag(1)-N(3)	173.01(12)

Compound 5

Ag(1)-O(1W)#1	2.112(4)	Ag(1)-O(1W)	2.112(4)
K(1)-O(6)#2	2.683(2)	K(1)-O(4)	2.755(3)
K(1)-O(2)#3	2.766(4)	K(1)-O(8)#4	2.821(2)
K(1)-O(3)#3	2.869(3)	K(1)-O(1)#1	2.978(3)
K(1)-O(9)#3	3.002(3)	K(1)-O(2)#1	3.116(2)
K(1)-O(5)	3.139(2)	K(2)-O(5)	2.774(3)
K(2)-O(2W)	2.789(4)	K(2)-O(9)#3	2.831(3)
K(2)-O(8)#4	2.834(3)	K(2)-O(9)#4	2.845(3)
K(2)-O(8)#3	2.859(4)	K(2)-O(6)#5	2.913(2)
K(2)-O(5)#5	2.929(3)	K(2)-O(2W)#5	3.099(4)
K(3)-O(4)#1	2.779(2)	K(3)-O(4)#7	2.779(2)
K(3)-O(3)#8	2.780(3)	K(3)-O(3)#2	2.780(3)
K(3)-O(6)#1	3.154(3)	K(3)-O(6)#7	3.154(3)
K(3)-O(2)#9	3.330(3)	O(1W)#1-Ag(1)-O(1W)	180.000(1)
K(3)-O(2)	3.330(3)	O(6)#2-K(1)-O(2)#3	82.10(11)
O(6)#2-K(1)-O(4)	159.24(7)	O(4)-K(1)-O(2)#3	115.14(11)
O(6)#2-K(1)-O(8)#4	69.78(8)	O(2)#3-K(1)-O(8)#4	130.58(7)
O(4)-K(1)-O(8)#4	103.30(8)	O(6)#2-K(1)-O(3)#3	127.41(11)
O(2)#3-K(1)-O(3)#3	50.88(7)	O(8)#4-K(1)-O(3)#3	120.81(7)
O(6)#2-K(1)-O(1)#1	77.68(9)	O(4)-K(1)-O(1)#1	89.52(9)
O(2)#3-K(1)-O(1)#1	92.65(7)	O(8)#4-K(1)-O(1)#1	118.43(7)
O(6)#2-K(1)-O(9)#3	79.81(11)	O(4)-K(1)-O(9)#3	117.10(10)
O(2)#3-K(1)-O(9)#3	65.26(8)	O(8)#4-K(1)-O(9)#3	70.21(7)
O(3)#3-K(1)-O(9)#3	61.38(6)	O(1)#1-K(1)-O(9)#3	150.39(7)
O(6)#2-K(1)-O(2)#1	110.74(7)	O(4)-K(1)-O(2)#1	69.46(6)
O(2)#3-K(1)-O(2)#1	66.39(8)	O(8)#4-K(1)-O(2)#1	161.58(7)
O(3)#3-K(1)-O(2)#1	74.32(6)	O(1)#1-K(1)-O(2)#1	46.65(7)
O(9)#3-K(1)-O(2)#1	128.20(6)	O(6)#2-K(1)-O(5)	133.14(7)
O(4)-K(1)-O(5)	48.04(6)	O(2)#3-K(1)-O(5)	123.21(9)
O(8)#4-K(1)-O(5)	63.99(7)	O(3)#3-K(1)-O(5)	74.11(10)
O(1)#1-K(1)-O(5)	131.62(10)	O(9)#3-K(1)-O(5)	77.99(11)
O(2)#1-K(1)-O(5)	115.47(6)	O(5)-K(2)-O(2W)	72.34(10)
O(5)-K(2)-O(9)#3	87.21(10)	O(2W)-K(2)-O(9)#3	159.47(7)
O(5)-K(2)-O(8)#4	68.82(7)	O(2W)-K(2)-O(8)#4	97.52(9)
O(9)#3-K(2)-O(8)#4	72.56(8)	O(5)-K(2)-O(9)#4	119.58(7)

O(2W)-K(2)-O(9)#4	90.93(8)	O(9)#3-K(2)-O(9)#4	97.76(5)
O(8)#4-K(2)-O(9)#4	56.17(7)	O(5)-K(2)-O(8)#3	143.22(7)
O(2W)-K(2)-O(8)#3	144.44(9)	O(9)#3-K(2)-O(8)#3	56.04(8)
O(8)#4-K(2)-O(8)#3	98.08(7)	O(9)#4-K(2)-O(8)#3	71.98(7)
O(5)-K(2)-O(6)#5	146.61(7)	O(2W)-K(2)-O(6)#5	80.28(9)
O(9)#3-K(2)-O(6)#5	119.59(9)	O(8)#4-K(2)-O(6)#5	134.96(6)
O(9)#4-K(2)-O(6)#5	78.82(7)	O(8)#3-K(2)-O(6)#5	66.15(6)
O(5)-K(2)-O(5)#5	101.70(6)	O(2W)-K(2)-O(5)#5	66.70(8)
O(9)#3-K(2)-O(5)#5	121.16(7)	O(8)#4-K(2)-O(5)#5	163.87(7)
O(8)#3-K(2)-O(5)#5	97.04(7)	O(6)#5-K(2)-O(5)#5	48.65(6)
O(5)-K(2)-O(2W)#5	64.50(8)	O(2W)-K(2)-O(2W)#5	104.74(8)
O(4)#1-K(3)-O(4)#7	180.0	O(9)#3-K(2)-O(2W)#5	66.59(7)
O(4)#1-K(3)-O(3)#8	74.24(10)	O(8)#4-K(2)-O(2W)#5	117.83(7)
O(4)#7-K(3)-O(3)#8	105.76(10)	O(9)#4-K(2)-O(2W)#5	164.12(7)
O(4)#1-K(3)-O(3)#2	105.76(10)	O(8)#3-K(2)-O(2W)#5	95.79(8)
O(4)#7-K(3)-O(3)#2	74.24(10)	O(6)#5-K(2)-O(2W)#5	105.96(7)
O(3)#8-K(3)-O(3)#2	180.0	O(5)#5-K(2)-O(2W)#5	65.94(8)
O(4)#1-K(3)-O(6)#1	47.33(7)	O(4)#7-K(3)-O(6)#1	132.67(7)
O(3)#8-K(3)-O(6)#1	84.46(9)	O(3)#2-K(3)-O(6)#1	95.54(9)
O(4)#1-K(3)-O(6)#7	132.67(7)	O(4)#7-K(3)-O(6)#7	47.33(7)
O(3)#8-K(3)-O(6)#7	95.54(9)	O(3)#2-K(3)-O(6)#	84.46(9)
O(6)#1-K(3)-O(6)#7	180.00(5)	O(4)#1-K(3)-O(2)#9	114.04(8)
O(4)#7-K(3)-O(2)#9	65.96(8)	O(3)#8-K(3)-O(2)#9	107.96(6)
O(3)#2-K(3)-O(2)#9	72.04(6)	O(6)#1-K(3)-O(2)#9	66.93(6)
O(6)#7-K(3)-O(2)#9	113.07(6)	O(4)#1-K(3)-O(2)	65.96(8)
O(4)#7-K(3)-O(2)	114.04(8)	O(3)#8-K(3)-O(2)	72.04(6)
O(3)#2-K(3)-O(2)	107.96(6)	O(6)#1-K(3)-O(2)	113.07(6)
O(6)#7-K(3)-O(2)	66.93(6)	O(2)#9-K(3)-O(2)	180.0

Compound 6

Ag(1)-N(2)	2.171(6)	Ag(1)-N(1)	2.176(6)
Ag(2)-N(3)	2.171(6)	Ag(2)-N(4)	2.194(6)
Ag(3)-N(6)	2.153(6)	Ag(3)-N(5)	2.164(6)
Ag(2)-O(7)	2.795(50)	Ag(1)-O(2)	2.655(46)
Ag(2)-O(6)	2.646(15)	N(3)-Ag(2)-N(4)	162.0(2)
N(2)-Ag(1)-N(1)	168.7(2)	N(6)-Ag(3)-N(5)	163.1(3)

Compound 7

Ag(1)-N(2)#1	2.137(5)	Ag(1)-N(1)	2.166(4)
Ag(2)-N(6)	2.150(4)	Ag(2)-N(7)#1	2.155(4)
Ag(2)-Ag(3)	3.2539(15)	Ag(3)-N(5)#1	2.150(5)
Ag(3)-N(4)	2.163(4)	Ag(1)-O(2)#1	2.683(8)
Ag(2)-O(3)#3	2.859(6)	Ag(3)-O(6)#1	2.832(8)
N(6)-Ag(2)-N(7)#1	178.5(4)	N(6)-Ag(2)-Ag(3)	82.30(19)
N(7)#1-Ag(2)-Ag(3)	96.8(2)	N(5)#1-Ag(3)-N(4)	167.8(3)
N(5)#1-Ag(3)-Ag(2)	88.63(15)	N(4)-Ag(3)-Ag(2)	103.20(17)

N(2)#1-Ag(1)-N(1) 174.0(3)

Compound 8

Ag(1)-N(10)	2.070(17)	Ag(1)-N(7)#1	2.109(12)
Ag(2)-N(1)	2.059(18)	Ag(2)-N(4)#1	2.074(13)
Ag(2)-O(7)	2.595(11)	Ag(3)-N(5)	2.143(17)
Ag(1)-O(5)#2	2.837(14)	Ag(3)-O(8)#3	2.770(15)
Ag(3)-N(12)#1	2.160(12)	N(10)-Ag(1)-N(7)#1	178.9(10)
N(1)-Ag(2)-N(4)#1	172.4(8)	N(1)-Ag(2)-O(7)	92.5(6)
N(4)#1-Ag(2)-O(7)	91.4(5)	N(5)-Ag(3)-N(12)#1	177.4(6)

Compound 9

Ag(1)-N(4)	2.369(4)	Ag(1)-N(2)#1	2.406(4)
Ag(1)-N(3)#2	2.442(4)	Ag(1)-O(2W)	2.587(5)
Ag(2)-N(1)	2.286(4)	Ag(2)-N(1)#3	2.286(4)
Ag(2)-O(1W)	2.599(10)	Ag(2)-O(5)#2	2.684(7)
Ag(1)-O2S#1	2.601(5)	N(2)#1-Ag(1)-N(3)#2	126.01(14)
N(1)-Ag(2)-N(1)#3	165.8(3)	N(2)#1-Ag(1)-O(2W)	90.89(16)
N(1)-Ag(2)-O(1W)	93.91(11)	N(3)#2-Ag(1)-O(2W)	94.44(16)
N(1)#3-Ag(2)-O(1W)	93.91(11)	N(4)-Ag(1)-N(2)#1	120.43(15)
N(4)-Ag(1)-O(2W)	93.52(16)		

[a] Symmetry operations: for **1**: #1 $x, -y+1/2, z-1/2$; #2 $x, -y+1/2, z+1/2$; for **2**: #1 $-x+1/2, y, z$; for **3**: #1 $x, y, z+1$; #2 $-x, -y+1, -z+1$; #3 $x, y, z-1$; for **4**: #1 $x, y-1, z$; #2 $x, y+1, z$; for **5**: #1 $-x, -y+1, -z+2$; #2 $x-1, y, z$; #3 $x-1, y+1, z$; #4 $-x, -y+1, -z+1$; #5 $-x, -y+2, -z+1$; #6 $-x-1, -y+2, -z+1$; #7 $x, y-1, z$; #8 $-x+1, -y, -z+2$; #9 $-x, -y, -z+2$; #10 $x+1, y-1, z$; #11 $x+1, y, z$; #12 $x, y+1, z$; for **7**: #1 $x, y-1, z$; #2 $x, y+1, z$; #3 $1+x, 1+y, z$; for **8**: #1 $x, y-1, z$; #2 $x, y+1, z$; #3 $1/2+x, 1.5-y, z-1/2$; for **9**: #1 $-x+1/2, y+1/2, z$; #2 $x, -y+1, z+1/2$; #3 $-x, y, z$; #4 $-x+1, y, z$; #5 $-x+1/2, y-1/2, z$; #6 $x, -y+1, z-1/2$.

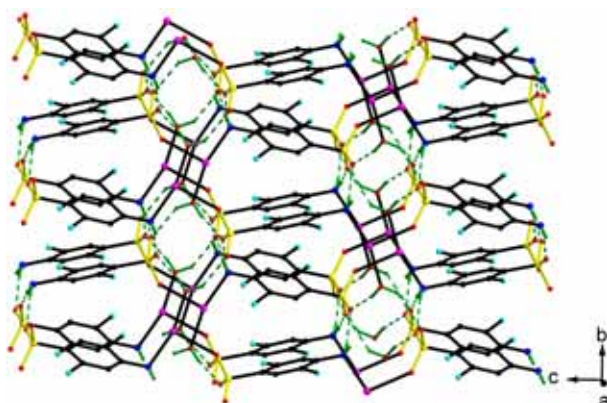


Figure S1. 3D supramolecular structure of **1** constructed through hydrogen bonds.

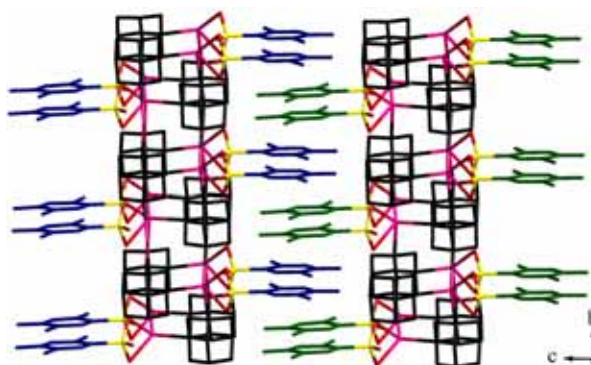


Figure S2. The 3D supramolecular structure of **2** constructed through π - π interactions.

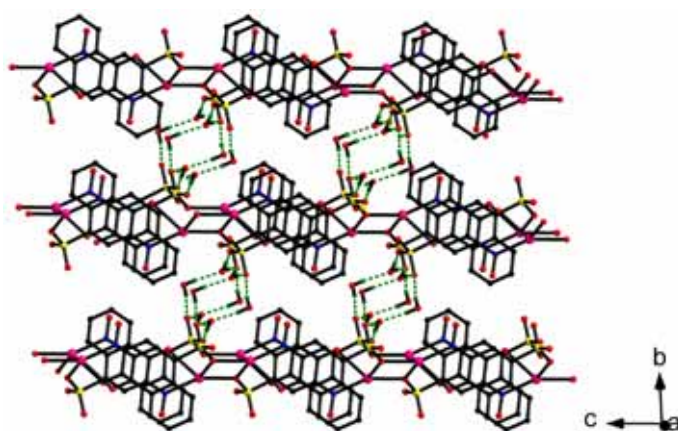


Figure S3. 3D supramolecular structure of **3** constructed through hydrogen bonds and π - π interactions.

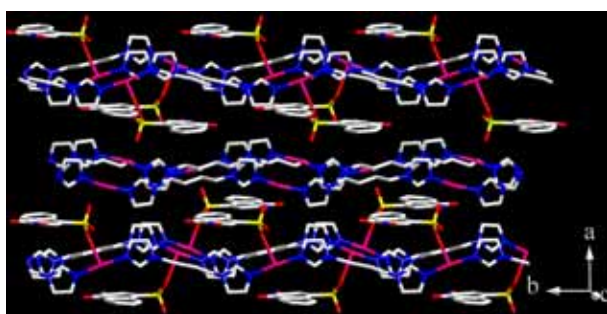
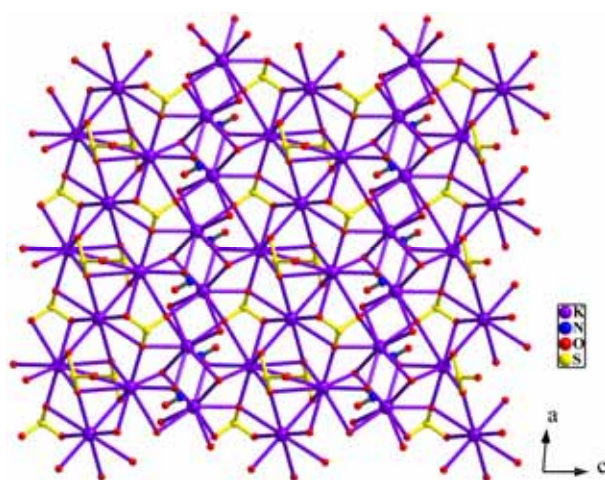
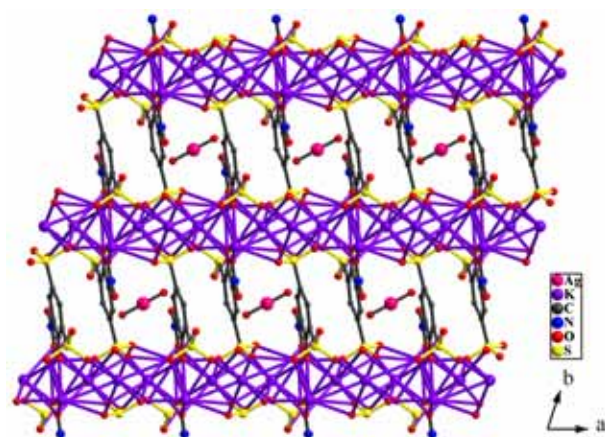


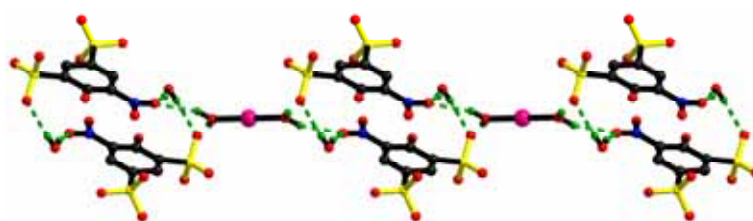
Figure S4. Packing diagram of compound **4**.



(a)



(b)



(c)

Figure S5. (a) The anionic chain via hydrogen bonds in **5**. (b) The inorganic polymeric layer in **5**. (c) View of the pillared layered structure of **5** along the *c* axis.

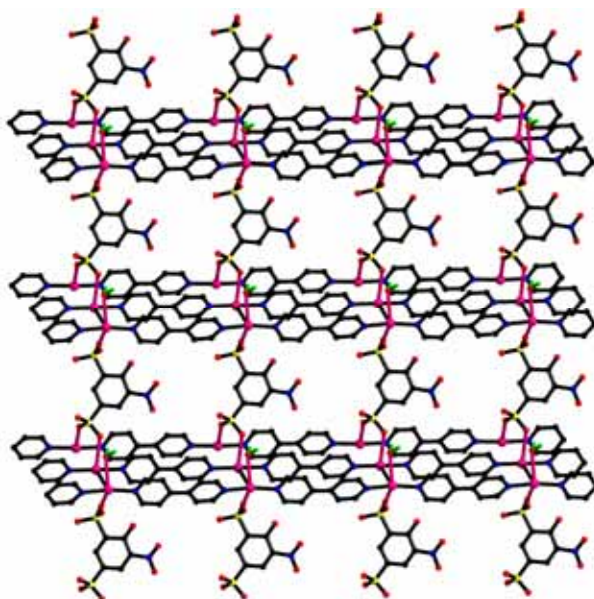


Figure S6. 2D polymeric structure in **7**.

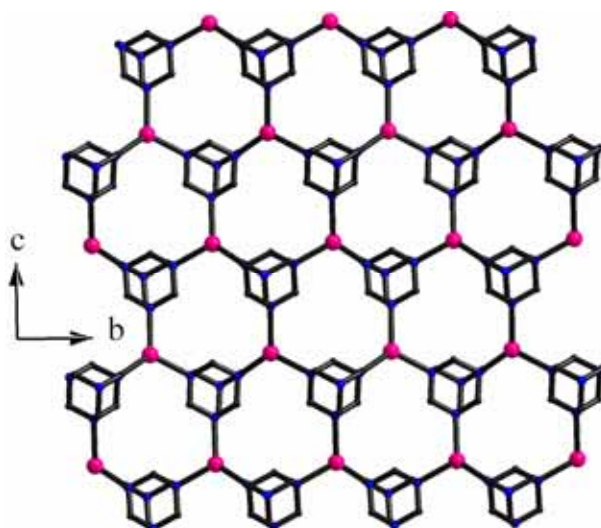
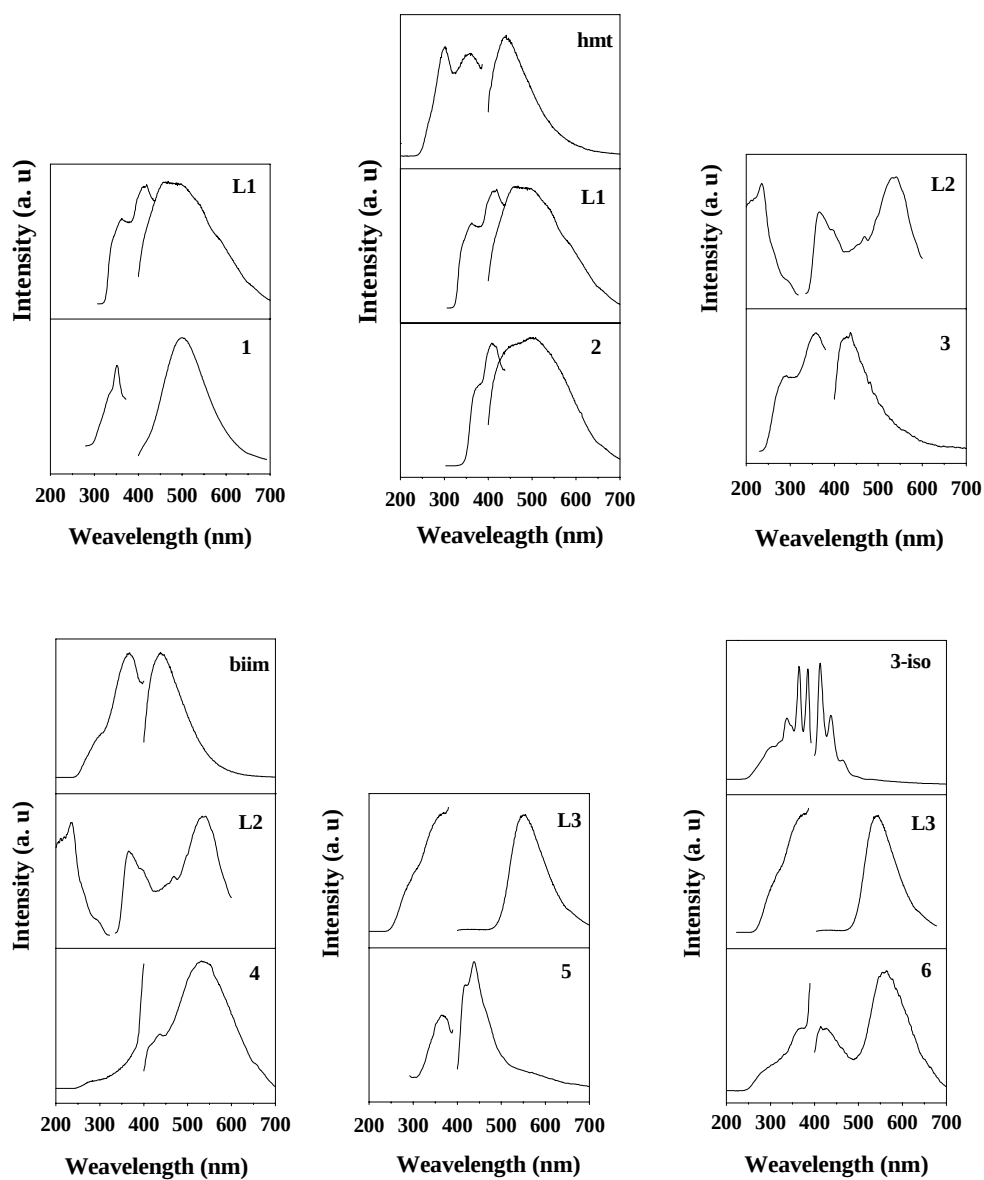


Figure S7. View of the 2D infinite honeycomb-like layers with hexagonal units along *a*-axis in **9**.



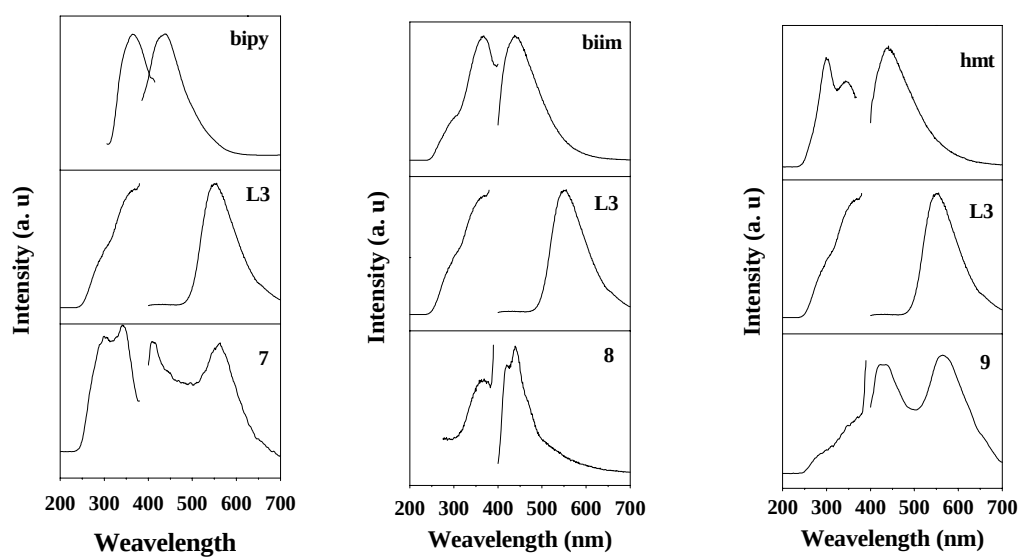


Figure S8. Solid-state photoluminescent spectra of **1-9** and free ligands [L3, hmt, bipy and biim] at room temperature.

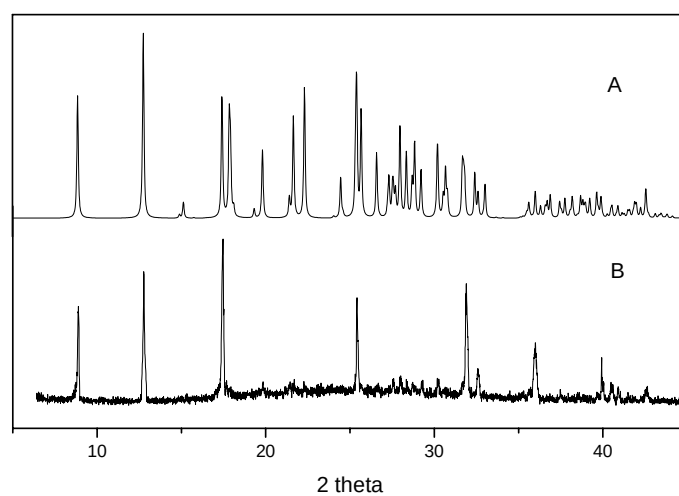


Fig. S9a Simulated (A) and measured (B) XRPD patterns of **1**.

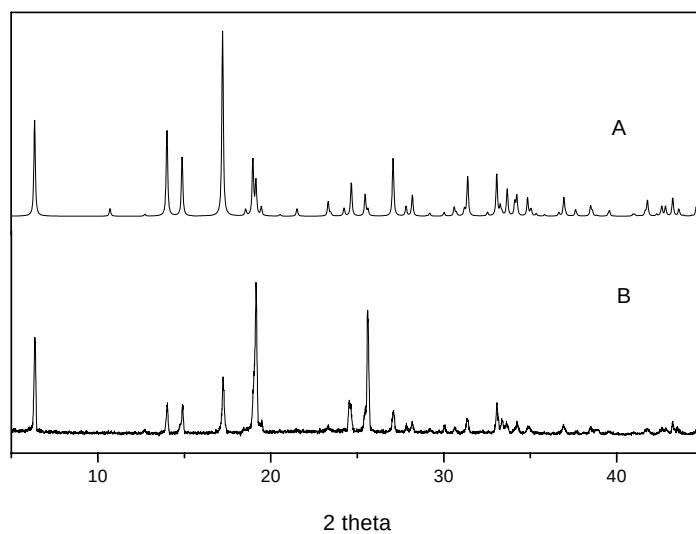


Fig. S9b Simulated (A) and measured (B) XRPD patterns of **2**.

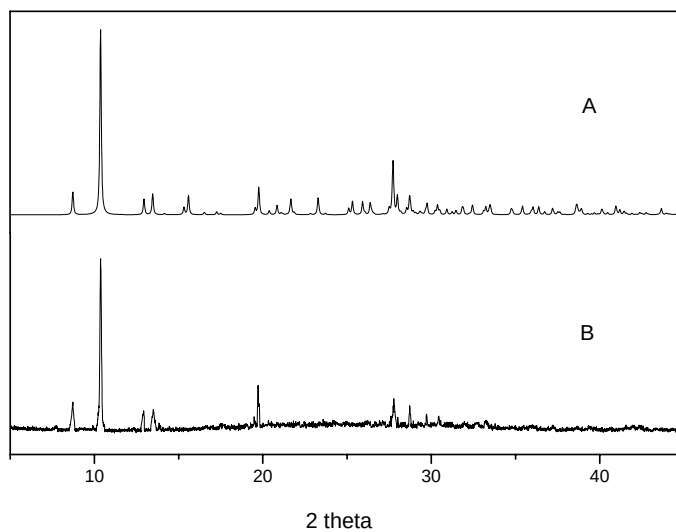


Fig. S9c Simulated (A) and measured (B) XRPD patterns of **3**.

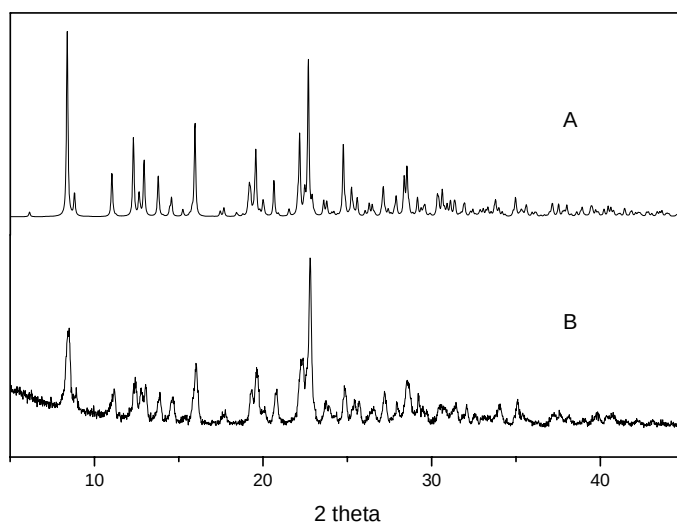


Fig. S9d Simulated (A) and measured (B) XRPD patterns of **4**.

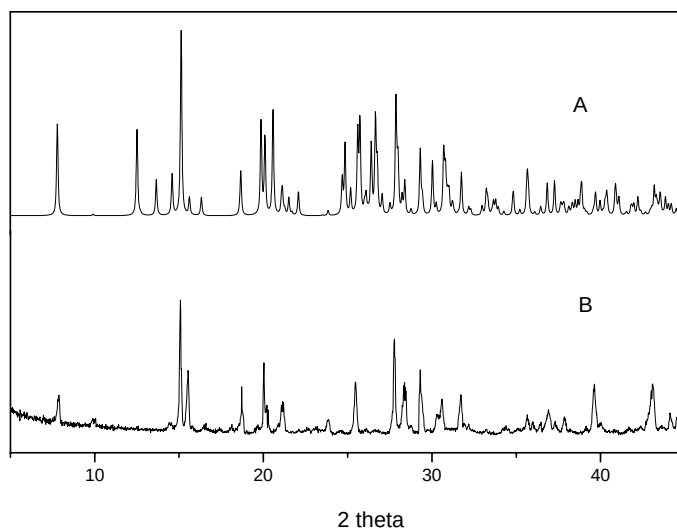


Fig. S9e Simulated (A) and measured (B) XRPD patterns of **5**.

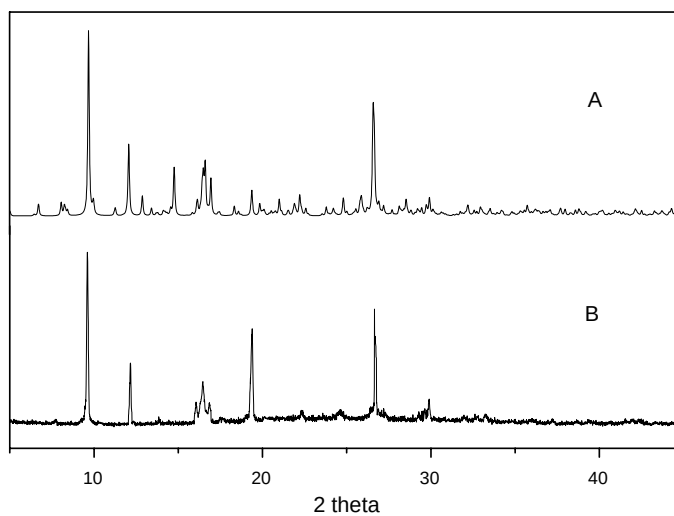


Fig. S9f Simulated (A) and measured (B) XRPD patterns of **6**.

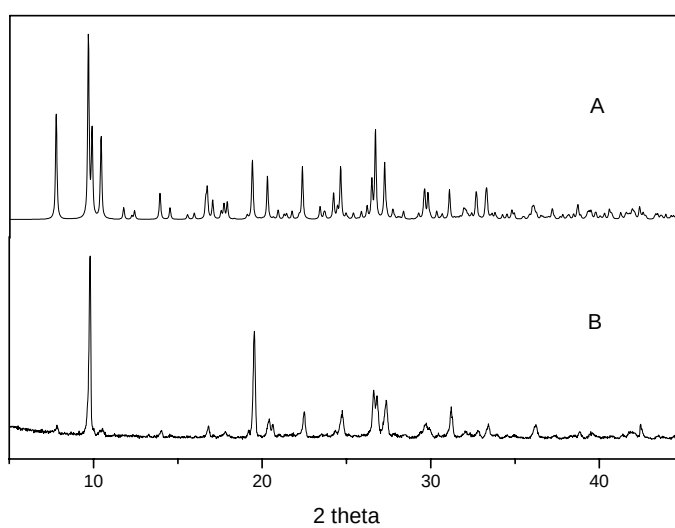


Fig. S9g Simulated (A) and measured (B) XRPD patterns of **7**.

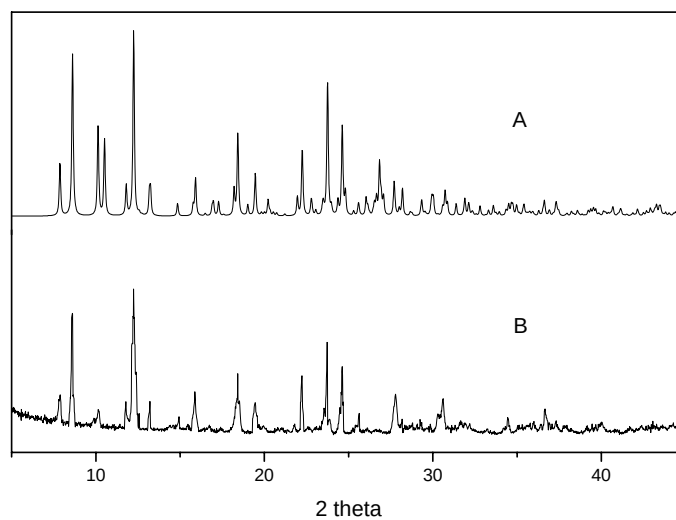


Fig. S9h Simulated (A) and measured (B) XRPD patterns of **8**.

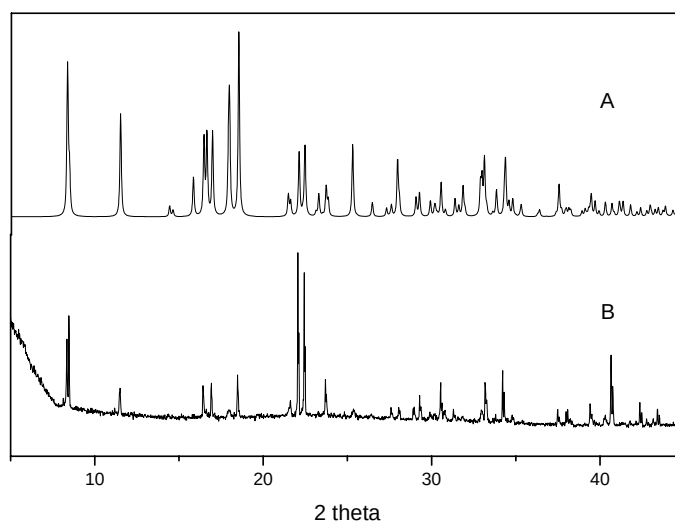


Fig. S9i Simulated (A) and measured (B) XRPD patterns of **9**.