Supporting information's for the manuscript

Structural diversities in Cu(I) and Ag(I) sulfonate coordination polymers and anion exchange properties

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Compounds	Temperature (°C)	Wt % loss (calc % loss)	Corresponding moieties	
	30-100	2.9 (2.5)	H ₂ O	
1	330-366	29.7 (27)	$H_2O + 4,4$ '-Bipyridyl	
	366-420	72	All H ₂ O and organic moieties	
	30-118	4.4 (4.5)	2H ₂ O	
2	231-367	44.7 (43.5)	2(4,4'-Bipyridyl)	
	267-473	73	All H ₂ O and organic moieties	
2	30-246	4.6 (4.58)	4H ₂ O	
	291-359	17.8 (18.5)	$2H_2O + 4,4$ '-Azobipyridyl	
3	359-598	69.4 (68.7)	3(4,4'-Azobipyridyl) + bds	
	600-710	74.2	All H ₂ O and organic moieties	
	30-100	6.3 (6)	3H ₂ O	
4	244-327	28.6 (28.4)	$H_2O + 4,4$ '-Azobipyridyl	
	327-460	49.5 (49.3)	4,4'-Azobipyridyl	
	460-621	73.8	All H ₂ O and organic moieties	
5	30-95	6.1 (6.2)	3H ₂ O	
	306-435	47.6 (48.5)	BPE	
	435-560	69	All H ₂ O and organic moieties	
6	3-100	3.1 (2.9)	3H ₂ O	
	320-368	30.1 (30)	$6H_2O + 2TBP$	
	368-420	72.7	All H ₂ O and organic moieties	

Table S1: TGA analysis for the compounds

Compounds	Absorption bands (nm)		
1	1 420(broad), 327(shoulder) and 248		
3	324 and 250		
2	486(broad), 329(shoulder) and 248	bad), 329(shoulder) and 248	
4	4 492, 375 and 259		
5	461(broad), 352, 250		
6	6 438, 275		

 Table S2: UV-visible bands for 1-6

 Table S3: Selected bond lengths and bond angles for 1-6

Compounds	Bond length (Å)	Bond angle (°)
1	Cu1-N1 1.910(6)	N1-Cu1-N2 169.5(2)
	Cu1-N2 1.915(6)	O1-Cu1-O_1 98.13
	Cu1-O1 2.561	N4-Cu2-N3 171.1(2)
	Cu_1-O1 2.490	O4-Cu2-Ow1 80.40
	Cu2-N3 1.911(6)	
	Cu2-N4 1.903(6)	
	Cu2-O2 2.771	
	Cu2-Ow1 2.563	
2	Ag1-N1 2.149(2)	N1-Ag1-N2 170.80(8)
	Ag1-N2 2.156(2)	O1-Ag1-O_1 103.98
	Ag2-N4 2.151(2)	O1-Ag1-N1 92.29
	Ag2-N3 2.154(2)	O1-Ag1-N2 94.08
	Ag1-O1 2.670	O_1-Ag1-N1 100.50
	Ag1-O_1 2.682	O_1-Ag1-N2 84.39
	Ag2-O4 2.862	N4-Ag2-N3 173.88(9)
	Ag2-Ow1 2.780	O4-Ag2-Ow1 178.02
	Ag1-Ag1 3.296(5)	O4-Ag2-N3 90.99
		O4-Ag2-N4 86.57
		Ow1-Ag2-N3 87.73
		Ow1-Ag2-N4 94.55
3	Cu1-N1 1.909(3)	N8-Cu1-N1 164.70(17)
	Cu1-O7 2.376(4)	N8-Cu1-O7 97.06(15)
	Cu2-N5 1.907(4)	N1-Cu1-O7 98.13(15)
	Cu2-N4 1.917(4)	N5-Cu2-N4 165.1(2)
	Cu2-O1 2.317(4)	N5-Cu2-O1 98.89(17)
	Cu3-N12 1.907(3)	N4-Cu2-O1 96.00(17)

$\begin{array}{c c} Cu3-011 2.339(4) & N12-Cu3-011 99.10(15) \\ Cu4-N16 1.895(4) & N13-Cu3-011 94.52(16) \\ Cu4-N9 1.897(4) & N16-Cu4-N9 168.37(19) \\ 4 & Ag1-N1 2.149(4) & N1 Ag1 N4 174.76(1) \\ Ag1-N4 2.150(4) & 01-Ag1-N1 89.93 \\ Ag1-01 2.794 & 01-Ag1-N1 92.10 \\ Ag2-N5 2.139(4) & N5 Ag2 N8 174.91(1) \\ Ag2-N5 2.139(4) & N5 Ag2 N8 174.91(1) \\ Ag2-N5 2.139(4) & N5 Ag2 N8 174.91(1) \\ Ag2-N6 2.786 & 06-Ag2-N5 91.71 \\ Ag2-06 2.786 & 06-Ag2-N8 89.69 \\ 5 & Ag1-N1 2.133(10) & N1-Ag1-N2 174.7(4) \\ Ag1-N2 2.127(10) & 0w1-Ag1-N2 91.75 \\ Ag1-N2 2.127(10) & 0w1-Ag1-N2 91.75 \\ Ag1-Ag_1 3.3537(11) \\ 6 & Ag1-N1 2.146(5) & N1-Ag1-N2 164.7(2) \\ Ag1-N2 2.151(5) & 01-Ag1-N1 102.12 \\ Ag1-O1 2.633 & 01-Ag1-N1 93.14 \\ Ag1-Ag1 3.211(10) & N3 Ag2 N4 166.96(2) \\ Ag2-N3 2.153(5) & 04-Ag2-N3 100.03 \\ Ag2-N4 2.161(5) & 04-Ag2-N4 92.88 \\ Ag2-04 2.688 & N6-Ag3-N5 171.80(2) \\ Ag3-N5 2.143(5) & 07-Ag3-N5 97.43 \\ Ag3-N5 2.143(5) & 07-Ag3-N5 97.43 \\ Ag3-N5 2.143(5) & 07-Ag3-N5 97.43 \\ Ag3-N7 2.130(5) \\ Ag4-N1 2.130(5) \\ Ag4-N1 2.130(5) \\ Ag4-N7 2.130(5) \\ Ag4-Ag4 3.162(12) \\ \end{array}$		Cu3-N13 1.911(3)	N12-Cu3-N13 166.33(17)	
$\begin{array}{c c} Cu4-N16 1.895(4) & N13-Cu3-O11 94.52(16) \\ Cu4-N9 1.897(4) & N16-Cu4-N9 168.37(19) \\ 4 & Ag1-N1 2.149(4) & N1 Ag1 N4 174.76(1) \\ Ag1-N4 2.150(4) & O1-Ag1-N1 89.93 \\ Ag1-O1 2.794 & O1-Ag1-N1 92.10 \\ Ag2-N5 2.139(4) & N5 Ag2 N8 174.91(1) \\ Ag2-N8 2.145(4) & O6-Ag2-N5 91.71 \\ Ag2-O6 2.786 & O6-Ag2-N8 89.69 \\ 5 & Ag1-N1 2.133(10) & N1-Ag1-N2 174.7(4) \\ Ag1-N2 2.127(10) & Ow1-Ag1-N1 92.38 \\ Ag1-Ow1 2.838 & Ow1-Ag1-N2 91.75 \\ Ag1-Ag_1 3.3537(11) \\ 6 & Ag1-N1 2.146(5) & N1-Ag1-N2 164.7(2) \\ Ag1-N2 2.151(5) & O1-Ag1-N1 102.12 \\ Ag1-O1 2.633 & O1-Ag1-N1 93.14 \\ Ag1-Ag1 3.211(10) & N3 Ag2 N4 166.96(2) \\ Ag2-N3 2.153(5) & O4-Ag2-N3 100.03 \\ Ag2-N4 2.161(5) & O4-Ag2-N4 92.88 \\ Ag2-O4 2.688 & N6-Ag3-N5 171.80(2) \\ Ag3-N6 2.133(5) & O7-Ag3-N5 97.43 \\ Ag3-N5 2.143(5) & O7-Ag3-N6 90.51 \\ Ag3-Ag2 3.236(8) & N8-Ag4-N7 171.81(19) \\ Ag3-O7 2.817 & O11-Ag4-N7 94.11 \\ Ag4-N8 2.124(5) & O11-Ag4-N8 87.18 \\ Ag4-O11 2.824 \\ Ag4-O11 2.824 \\ Ag4-Ag4 3.162(12) \\ \end{array}$		Cu3-O11 2.339(4)	N12-Cu3-O11 99.10(15)	
$\begin{array}{c c c c c c c } & Cu4-N9 1.897(4) & N16-Cu4-N9 168.37(19) \\ \hline 4 & Ag1-N1 2.149(4) & N1 Ag1 N4 174.76(1) \\ & Ag1-N1 2.150(4) & O1-Ag1-N1 89.93 \\ & Ag1-O1 2.794 & O1-Ag1-N1 89.93 \\ & Ag1-O1 2.794 & O1-Ag1-N1 92.10 \\ & Ag2-N5 2.139(4) & N5 Ag2 N8 174.91(1) \\ & Ag2-N8 2.145(4) & O6-Ag2-N5 91.71 \\ & Ag2-O6 2.786 & O6-Ag2-N8 89.69 \\ \hline 5 & Ag1-N1 2.133(10) & N1-Ag1-N2 174.7(4) \\ & Ag1-N2 2.127(10) & Ow1-Ag1-N1 92.38 \\ & Ag1-Ow1 2.838 & Ow1-Ag1-N2 91.75 \\ & Ag1-Ag_1 3.3537(11) \\ \hline 6 & Ag1-N1 2.146(5) & N1-Ag1-N2 164.7(2) \\ & Ag1-N2 2.151(5) & O1-Ag1-N1 102.12 \\ & Ag1-O1 2.633 & O1-Ag1-N1 93.14 \\ & Ag1-Ag1 3.211(10) & N3 Ag2 N4 166.96(2) \\ & Ag2-N3 2.153(5) & O4-Ag2-N3 100.03 \\ & Ag2-N4 2.161(5) & O4-Ag2-N4 92.88 \\ & Ag2-O4 2.688 & N6-Ag3-N5 171.80(2) \\ & Ag3-N6 2.133(5) & O7-Ag3-N5 97.43 \\ & Ag3-N5 2.143(5) & O7-Ag3-N5 97.43 \\ & Ag3-Ag2 3.236(8) & N8-Ag4-N7 171.81(19) \\ & Ag3-O7 2.817 & O11-Ag4-N7 94.11 \\ & Ag4-N8 2.124(5) & O11-Ag4-N7 94.11 \\ & Ag4-N8 2.124(5) & O11-Ag4-N8 87.18 \\ & Ag4-O11 2.824 \\ & Ag4-O11 2.824 \\ & Ag4-O11 2.824 \\ & Ag4-Ag4 3.162(12) \\ \hline \end{array}$		Cu4-N16 1.895(4)	N13-Cu3-O11 94.52(16)	
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Ag3-O7 2.817 O11-Ag4-N7 94.11 Ag4-N8 2.124(5) O11-Ag4-N8 87.18 Ag4-N7 2.130(5) Ag4-O11 2.824 Ag4-Ag4 3.162(12) Ag4-Ag4 3.162(12)		Ag3-Ag2 3.236(8)	N8-Ag4-N7 171.81(19)	
Ag4-N8 2.124(5) O11-Ag4-N8 87.18 Ag4-N7 2.130(5) Ag4-O11 2.824 Ag4-Ag4 3.162(12)		Ag3-O7 2.817	O11-Ag4-N7 94.11	
Ag4-N7 2.130(5) Ag4-O11 2.824 Ag4-Ag4 3.162(12)		Ag4-N8 2.124(5)	O11-Ag4-N8 87.18	
Ag4-O11 2.824 Ag4-Ag4 3.162(12)		Ag4-N7 2.130(5)		
Ag4-Ag4 3.162(12)		Ag4-O11 2.824		
		Ag4-Ag4 3.162(12)		

Compounds	D- Н··· <i>A</i>	H…A(Å)	<i>D</i> …A(Å)	<i>D</i> -H··· <i>A</i> (°)
4	Ow3-H7A…Ow4	1.86	2.699(9)	171
	Ow3-H7B Ow2	2.03	2.839(8)	158
	Ow4-H8A-O6	2.23	3.078(7)	172
	Ow2-H9A-Ow1	1.85	2.679(8)	164
	Ow2-H9B···O3	2.33	3.160(7)	166
	Ow1-H10A-Ow4	2.03	2.873(8)	169
	Ow1-H10B-O2	2.14	2.941(8)	158
6	Ow5-H00AO8	2.11	2.940(6)	165
	Ow5-H00BO3	2.04	2.853(6)	161
	Ow7-H00DOw6	2.02	2.835(4)	161
	Ow8-H00HOw9	2.04	2.812(6)	151
	Ow6-H00LOw7	2.07	2.835(4)	149

Table S4: Hydrogen bond parameters













Figure S1 PXRD pattern of compounds 1-6





Figure S2 TGA plots for 1-6



Figure S3 UV-Visible spectra of 1-6



Figure S4 PL spectra of 1-6



Figure S5 ¹H NMR spectra of the ketal product (2-ethyl-2-methyl-[1,3]-dioxolane, δ 3.92-4.00, m, 4H) from 2-butanone and ethylene glycol (δ 3.73-3.77, m, 4H). The integration of ketal product and precursor peak areas were used to determine yields



Figure S6 ¹H NMR spectra of the ketal product (δ 3.93-3.96, m, 4H) from 3-pentanone and ethylene glycol (δ 3.73-3.758, m, 4H). The integration of ketal product and precursor peak areas were used to determine yields



Figure S7 ¹H NMR spectra of the ketal product (δ 3.93-3.98, m, 4H) from acetone and ethylene glycol (δ 3.73-3.77, m, 4H). The integration of ketal product and precursor peak areas were used to determine yields











Figure S9 PXRD and FTIR of **1** and **3-6** for anion exchange with perchlorate. (a) Initial compound (red) (b) exchange products with ClO_4^- (black)



Figure S10 Color of crystal (a) 2 (b) after exchange with MnO₄-