

Supplementary Information-1

Table S1. The differential pore properties D_i (diameter, nm) and N_i (pore density, pores/g) of the three (3) porous spinels CoAl_2O_4 T= 500, 700 and 900°C discussed in this work are from refs [21–25,32]. The partial pressure $0 < (P/P_0) = P_i < 1$ where the D_i and N_i values were determined during nitrogen porosimetry is also shown.

Sample (P/P ₀) = P _i	CoAl ₂ O ₄ T= 500		CoAl ₂ O ₄ T= 700		CoAl ₂ O ₄ T= 900	
	D _i	N _i	D _i	N _i	D _i	N _i
0.98	309.91	9067759646	253.01	17078904103	252.87	49270843805
0.95	64.32	264539178163	61.01	398208017644	52.58	3558688705709
0.93	35.92	3240634117835	34.50	4737835742965	32.13	55880463537476
0.90	24.56	13496463981022	23.61	23407228784966	23.16	115284255696360
0.87	18.48	36924106931047	18.75	105176811313147	18.04	220932699966522
0.85	15.21	107154397816546	15.20	398841186909054	14.96	321454862855085
0.83	12.97	271262649926444	12.65	931772738815137	12.72	438298515784645
0.80	11.10	579015247002377	11.02	1397912537589040	11.20	447146669162489
0.78	9.86	919496329637454	9.81	1620391662815550	9.96	531851024309287
0.75	8.88	1577066476158460	8.76	1820790588951420	8.87	517892951107001
0.72	7.93	2214929972152800	7.91	1403459872921180	7.95	503048664074821
0.70	7.23	2566492503130900	7.30	1423016710372750	7.32	455868936687398
0.68	6.70	2817993584168780	6.74	1491420128094410	6.77	492629029232393
0.65	6.21	3820850102331120	6.18	1703805437846680	6.28	505673273099893
0.62	5.75	3552057602758900	5.77	1451743867000400	5.84	533212104726982
0.61	5.39	3866784775517090	5.41	1542446111474940	5.46	582746937690193
0.57	5.05	4166582639579400	5.07	1558045010896630	5.12	585396336196931
0.55	4.70	4821808963982410	4.77	1637306552978100	4.81	672001124831790
0.53	4.45	4114148845952150	4.50	1705532501656570	4.53	635594309064240
0.50	4.21	4205522879206860	4.25	1769008827172410	4.27	661743981311969
0.48	3.98	4839383060820790	4.02	1853915775503570	4.04	661028219427376
0.45	3.75	6409143566447780	3.79	2535478895656410	3.81	1103544879611580
0.40	3.46	8283807535148010	3.50	3562706121587550	3.52	1561852438566660
0.35	3.13	9728592218868120	3.16	4598116811719670	3.18	2139094642489160
0.30	2.84	11035702899640200	2.86	5040341936999040	2.88	2188567773607070
0.25	2.57	13194106946880800	2.59	5809115346957050	2.60	2776962403492060
0.20	2.33	16680920017920600	2.34	7023118560445030	2.35	3648211432744950
0.15	2.09	19807059217500600	2.10	9979068412838220	2.11	6182583635018640
0.10	1.85	19567259291052600	1.86	15648402201583900	1.87	12006045917612600

Supplementary Information-2

Table S2. Pore properties D_i (diameter, nm) and N_i (pore density, pores/g) of eight (8) porous volcanic rocks or mimics plus one (1) sample of porous soil(last double column) discussed in the present work. The original publications are cited.

Sample code name Short description	ET 8, Lab made volcanic rock mimic [36]		ET 9, Lab made volcanic rock mimic [36]		Scoria, Magmatic rock from Etna mountain, Italy [37-39]		Pumice, Magmatic rock from Volcano Isola, Italy [37-39]		T28-G4-24, Magmatic rock from Tarawera Volcano, New Zealand [40]		T43-07-67, Magmatic rock from Tarawera Volcano, New Zealand [40]		T47-12-56, Magmatic rock from Tarawera Volcano, New Zealand [40]		T47-23-35, Magmatic rock from Tarawera Volcano, New Zealand [40]		Soil sample from Nannin, Guangxi,China [35]	
Properties	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N
	50000	44356	10000	2421754	1600000	0.061	700000	0.21654	56683	565.7	55716	438.4	100600	652.5	71044	608.8	274	15939694740
	100000	1636	30000	133251	1900000	0.067	1130000	0.04979	71884	282.81	71297	285.94	138570	410.8	88871	406.7	316	8974287945
	150000	602	40000	40135	1800000	0.041	1470000	0.00985	89045	196.14	88994	184.6	186192	237.12	112639	258.81	392	3958858690
	200000	245	50000	29732	2100000	0.045	1900000	0.00258	112039	112.2	112011	121.63	252947	142.57	140919	140.13	422	2974883754
	250000	221	60000	19931	2100000	0.037	2330000	0.00338	141351	76.82	140679	68.79	342713	90.21	179808	82.27	487	1742047530
	300000	40	70000	8955	2300000	0.030	2500000	0.00075	178789	45.97	179271	41.57	460479	53.96	226428	44.54	523	1302326867
	350000	49	80000	10938	2000000	0.025	2900000	0.00044	227332	29.516	224698	25.765	630798	23.901	283302	18.927	650	624122731
	400000	12	90000	9897	1900000	0.022	3330000	0.00031	284557	26.464	281061	12.133	856998	10.589	359170	7.418	750	370953950
	450000	33	95000	6003	2200000	0.018	3730000	0.00030	358996	13.749	355943	7.482	1181708	6.038	446427	3.2557	866	229488010
	500000	16	100000	1808	2600000	0.017	4300000	0.00034	445862	6.162	444294	3.8419	1586098	2.8335	569705	1.3834	986	147706634
	650000	4	150000	518	2400000	0.012	3900000	0.00006	566905	2.9832	558020	1.9428	2166806	1.2296	717447	0.6798	1155	87058263
	700000	7	200000	270	2700000	0.014	4600000	0.00002	713346	1.3032	709643	0.7975	2951889	0.6092	891846	0.24183	1334	53365428
	900000	8	250000	99	2800000	0.010	4900000	0.00014	892915	0.4547	891312	0.30173	4006083	0.30027	1130603	0.10614	1655	26303286
			300000	90	3000000	0.009	5400000	0.00014	1129406	0.17137	1124087	0.14875	5440640	0.11771	1424098	0.036554	2054	12899415
			350000	33	3200000	0.011	6100000	0.00015	1410003	0.09494	1397398	0.05744	7338039	0.07565	1782584	0.006387	2207	10051711
			400000	22	3300000	0.010	5700000	0.00006	1788216	0.032079	1765997	0.02637	9755061	0.030707	2260893	0.001063	2550	6292019
			500000	11	3100000	0.006	6500000	0.00005	2261778	0.01084	2241197	0.014614	10027900	0.008858	2846099	0.001172	3924	1480062
			550000	8	3300000	0.004	6900000	0.00004	2838573	0.003782	2795181	0.0027584	13737889	0.005219	3582696	0.001401	4870	774248
			700000	3	3600000	0.005	7300000	0.00006	4482600	0.001014	3542175	0.003968	18077151	0.002723	4479917	0.002133	5623	461073
			900000	3	3700000	0.006	7600000	0.00006	5640401	0.00158	4429962	0.0020294	18477789	0.001193			8660	103269
					3700000	0.007	7900000	0.00010					25444270	0.001404			10000	67069
					3500000	0.004	8900000	0.00005					34127148	0.00214				
					4200000	0.004	9300000	0.00002										
					4700000	0.004	9700000	0.00002										
					4500000	0.003	10100000	0.00002										
					4800000	0.002	11100000	0.00002										
					4800000	0.002	11600000	0.00002										
					5200000	0.002	12300000	0.00002										
					6100000	0.002	13100000	0.00002										
					6300000	0.002	13700000	0.00002										
					6800000	0.002	15700000	0.00002										
					7300000	0.002	21200000	0.00003										
					7400000	0.002	24500000	0.00001										
					9400000	0.002	28100000	0.00001										
					9500000	0.002												
					10000000	0.002												
					13400000	0.002												
					13600000	0.002												
					16200000	0.002												

Supplementary Information -3.

Table S3. The seventeen (17) different categories of porous solids that are depicted in Figure 3 by 17 different colored points as follows: 1-(■); 2-(●); 3-(▲); 4-(▼); 5-(◆); 6-(◀); 7-(▶); 8-(⬢); 9-(★); 10-(◆); 11-(●); 12-(+); 13-(×); 14-(✱); 15-(-); 16-(⌀); 17-(■). The total number of samples is 206. Original sources of data and details about their pore properties are in ref.[32].

No of group and Symbol in Figure 3	Number and short description of samples in the group
1-(■)	Twelve (12) porous materials, of which six (6) mesoporous silicas SiO_2 and six (6) porous spinels CoAl_2O_4
2-(●)	Sixteen (16) Porous Alumino-Phosphoro-Vanadate materials $\text{Al}_{100}\text{P}_x\text{V}_y$ ($x, y = 0, 5, 10, 20$)
3-(▲)	Eight (8) samples of Porous Montmorillonite Pillared with LaNiO_x perovskite species
4-(▼)	Fifteen (15) nanostructured mesoporous solids of MCM-48, SBA-15 and SBA-16 type
5-(◆)	Five (5) MCM-type mesoporous solids with Al and Ti heteroatoms
6-(◀)	Fifteen (15) mixed oxides $(\text{ZrO}_2)_{1-x}(\text{CeO}_2)_x$ -T °C
7-(▶)	Eight porous materials, MSU, MCM-41, Zeolite beta and 5 mechanical mixtures (x%) MCM- 41+ (1-x%) Zeolite beta
8-(⬢)	Ten (10) porous materials of which Six (6) mesoporous MCM's and Four (4) silicas with modified surface.
9-(★)	Six (6) organized mesoporous silicas of MCM type.
10-(◆)	Nine (9) organized mesoporous silicates (OMSi) containing cobalt and cerium oxidic species.
11-(●)	Eighteen (18) organized mesoporous silico - nickelates (OMSiNi) and silico - lanthano-nickelates (OMSiLaNi).
12-(+)	Sixteen (16) Porous Alumino-Phosphoro - Cerate materials $\text{Al}_{100}\text{P}_x\text{Ce}_y$ ($x, y = 0, 5, 10, 20$).
13-(×)	Twenty two (22) Mesoporous Alumino- Phospho - Metalate Matrerials $\text{Al}_{100}\text{P}_x\text{M}_{20}$ ($x = 0, 4.5, 9, 18, 36, 72, 144$).
14-(✱)	Ten (10) samples of $\text{SiO}_2(\text{OA})_n$ silicas
15-(-)	Five (5) mesoporous MCM-41 materials with different ratios of Si/Al and Si/Ti.
16-(⌀)	Twenty four (24) oxidic porous materials $\text{MnO}_x/\text{T/pH}/^\circ\text{C}$ obtained via hydrolysis of multinuclear Mn - complexes
17-(■)	Nine (9) Alumino-Phosphoro-Ferrates $\text{Al}_{100}\text{P}_x\text{Fe}_y$ ($x = 0, 15, 60; y = 0, 5, 20$).
	Total number of samples 206