Electronic Supplementary Material (ESI) for RSC Advances.

Effects of electrochemical reaction and surface morphology on electroactive surface area of porous copper manufactured by Lost Carbonate Sintering

Supplementary Information

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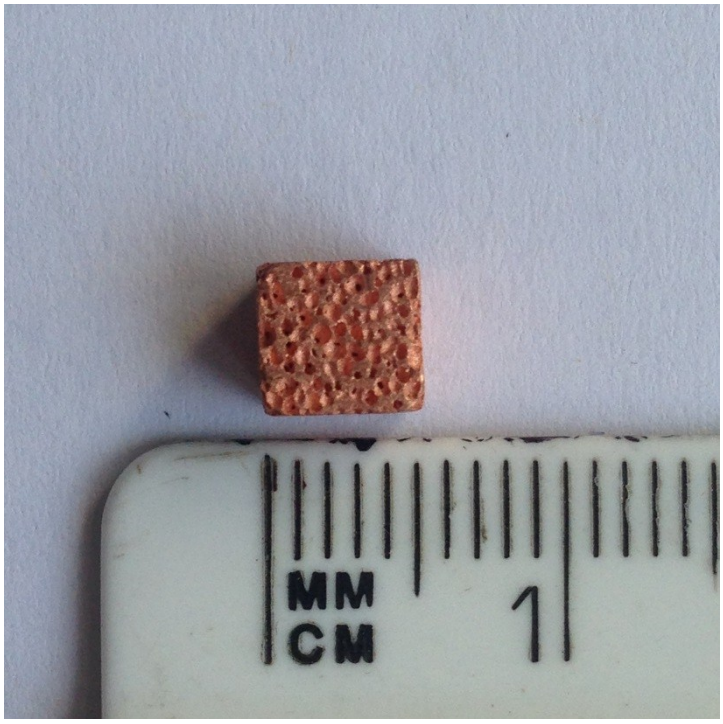

Fig. S1 The LCS porous Cu with a size of 5mm×5mm×4.8mm

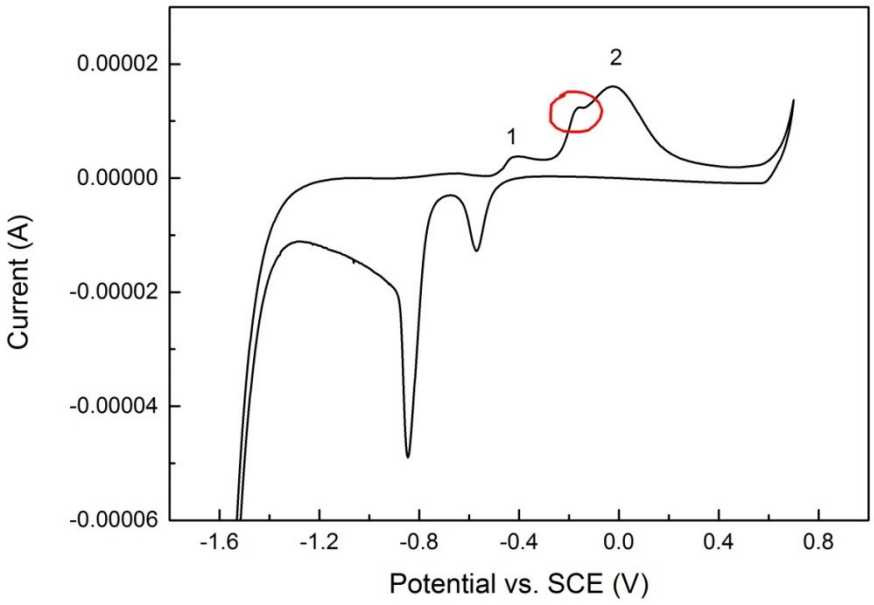

Fig. S2 The current-potential plot of a copper plate with a geometric surface area of 0.0543 cm^2 in 0.1 M KOH in the potential range of -1.6 to 0.7 V at a scan rate of 0.01 V/s

Another peak (marked in Fig. S2) occurs between peak 1 and peak 2 for copper plate. It is associated with the reaction below [1, 2]:

$$Cu_2O + 2OH^- + H_2O \rightarrow 2Cu(OH)_2 + 2e$$

This reaction is very sensitive to measurement conditions, e.g., scan rate. It is difficult to find this peak from the current-potential plots of the LCS Cu samples.

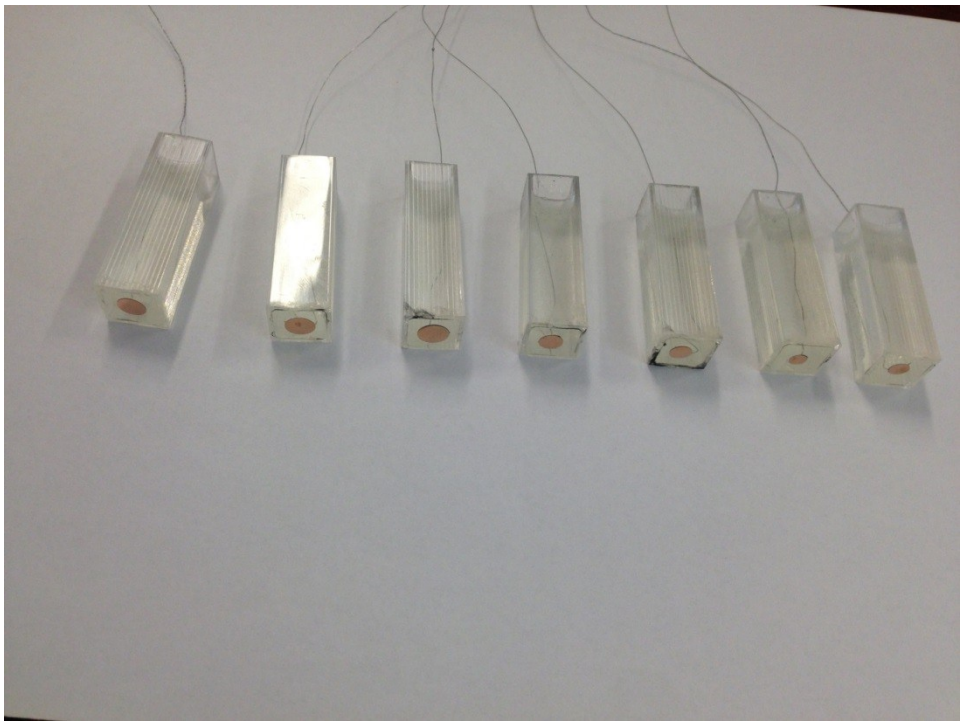

Fig. S3 Mirror polished copper plates with known geometric surface areas of 0.0543, 0.104 0.137, 0.171, 0.211, 0.252, 0.299 cm^2 (from right to left)

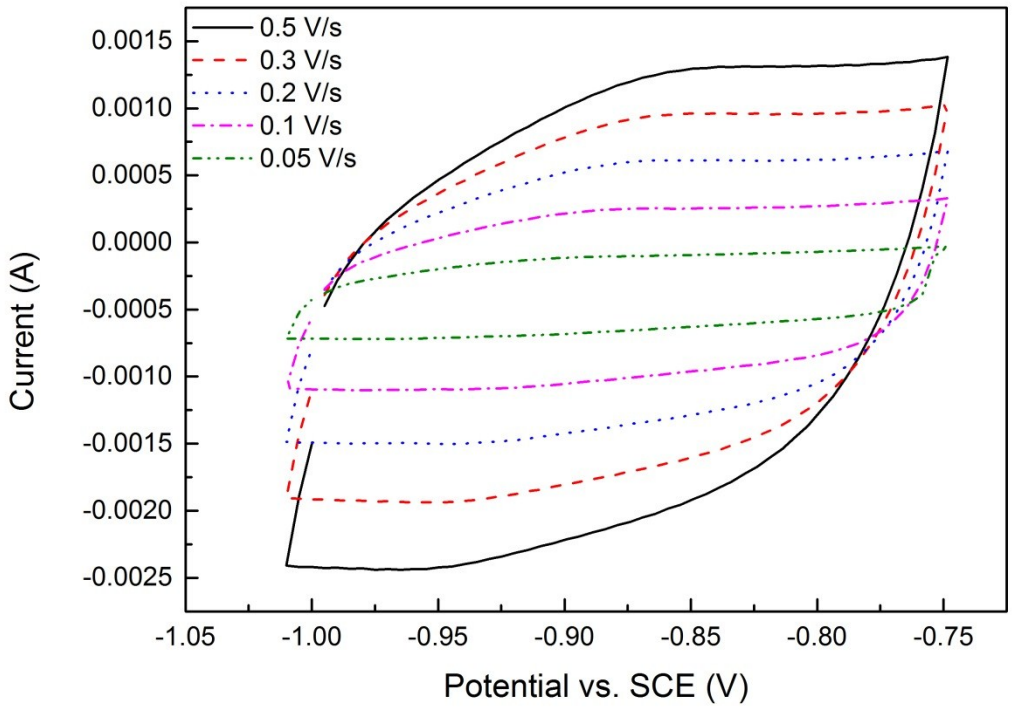

Fig. S4 Current-potential plots of the LCS Cu for real surface area measurement

Table S1 A_{Cu^+} (cm^{-1}) of the LCS Cu under different treatment conditions

Particle size (μm) / Porosity	Treatment Conditions															
	850 ˚C				850 ˚C & Etching				950 ˚C				950 ˚C & Etching			
	< 20	20-45	45-75	75-90	< 20	20-45	45-75	75-90	< 20	20-45	45-75	75-90	<20	20-45	45-75	75-90
0.50	534	742	841	707	435	632	659	519	219	222	303	204	142	177	226	189
0.55	637	807	686	727	538	605	502	548	282	246	298	261	213	191	206	217
0.60	795	787	772	739	520	625	579	550	257	270	308	258	197	214	229	188
0.65	579	791	743	610	491	626	555	397	212	313	322	282	176	228	230	227
0.70	601	835	718	677	-	-	-	-	253	345	368	284	-	-	-	-
0.75	631	739	688	522	-	-	-	-	317	280	398	283	-	-	-	-

Table S2 A_{OH^-} (cm^{-1}) of the LCS Cu under different treatment conditions

Particle size (μm) / Porosity	Treatment Conditions															
	850 ˚C				850 ˚C & Etching				950 ˚C				950 ˚C & Etching			
	< 20	20-45	45-75	75-90	< 20	20-45	45-75	75-90	< 20	20-45	45-75	75-90	<20	20-45	45-75	75-90
0.50	249	277	369	262	208	246	337	288	123	144	191	130	101	133	181	165
0.55	270	296	371	300	248	238	353	272	186	166	189	176	166	162	192	189
0.60	365	305	313	329	250	321	247	287	219	185	201	158	174	193	190	124
0.65	265	324	310	278	257	303	249	253	158	189	214	203	161	200	202	183
0.70	228	371	326	343	-	-	-	-	201	179	252	235	-	-	-	-
0.75	299	332	337	275	-	-	-	-	222	218	266	242	-	-	-	-

Table S3 A_r (cm^{-1}) of the LCS Cu under different treatment conditions

Particle size (μm) / Porosity	Treatment Conditions															
	850 ˚C				850 ˚C & Etching				950 ˚C				950 ˚C & Etching			
	< 20	20-45	45-75	75-90	< 20	20-45	45-75	75-90	< 20	20-45	45-75	75-90	<20	20-45	45-75	75-90
0.5	1461	1720	1615	1624	1278	1683	1462	1466	677	929	959	890	677	851	1211	851
0.55	1801	1878	1885	1724	1456	1678	1615	1380	965	1166	1104	1005	1166	925	1341	1005
0.6	1902	1870	1808	1689	1585	1675	1577	1375	1274	1006	1250	1006	1234	1200	1074	851
0.65	1771	1895	1760	1545	1456	1727	1440	1120	1074	1144	1314	1155	959	1104	1115	1035
0.7	1848	2015	1732	1729	-	-	-	-	1138	1341	1461	1253	-	-	-	-
0.75	1664	1909	1867	1711	-	-	-	-	1407	1353	1575	1340	-	-	-	-

References

1. N. Hampson, J. Lee and K. Macdonald, *Journal of Electroanalytical Chemistry and Interfacial Electrochemistry*, 1972, **34**, 91-99.
2. J. Ambrose, R. Barradas and D. Shoesmith, *Journal of Electroanalytical Chemistry and Interfacial Electrochemistry*, 1973, **47**, 47-64.