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# 面向$CO_2$电化学转化的铜基催化剂研究进展

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# Recent Advances in Electrochemical $CO_2$ Reduction Using Copper-Based Catalysts

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**表 S1　部分电极的 $CO_2$ 还原产物及测试条件**

**Table S1　Reduction products and test conditions of some electrodes.**

| Electrode | *E*/V (*vs* RHE) | Electrolyte | Product | FE | Ref. |
|---|---|---|---|---|---|
| Cu Nanowires | −1.25 | $KHCO_3$ | $CH_4$ | 55% | 24 |
| $Cu_2Pd$ nanoalloy | −1.8 (*vs* $Ag/Ag^+$) | $TBAPF_6/CH_3CN$, $H_2O$ | $CH_4$ | 51% | 141 |
| CuS@NF | −1.1 | $KHCO_3$ | $CH_4$ | 73 ± 5% | 116 |
| Cu atom-pair | −0.78 | $NaHCO_3$ | CO | 92% | 74 |
| AuCu NPs | −0.77 | $KHCO_3$ | CO | 80% | 134 |
| CuIn alloy nanowires | −0.6 | $KHCO_3$ | CO | 68.2% | 136 |
| Core-shell structure of $Cu_xO$ covered by $In(OH)_3$ | −1.17 | KOH | CO | > 90% | 137 |
| nanoporous Cu-In | −0.95 | $KHCO_3$ | CO | 91% | 138 |
| $CuO/In_2O_3$ | −0.7 | $KHCO_3$ | CO | 93% | 139 |
| Cu-Pd alloy NPs | −0.9 | $KHCO_3$ | CO | 87% | 140 |
| CuS | −0.8 | $KHCO_3$ | $HCOO^-$ | 80% | 114 |
| CuAu | −0.6 | $KHCO_3$ | $HCOO^-$ | 81% | 19 |
| $CuSn_3$ | −0.5 | $KHCO_3$ | $HCOO^-$ | 95% | 125 |
| $Cu_2S/Cu$ | −2.0 (*vs* $Ag/Ag^+$) | MeCN, $BmimBF_4$ | HCOOH | 85% | 117 |
| $Cu_3Sn/Cu_6Sn_5$ | −1.0 | $NaHCO_3$ | HCOOH | 82% | 129 |
| CuZn | −1.1 | $KHCO_3$ | HCOOH | 60% | 12 |
| graphite/carbon NPs/Cu/PTFE | −0.55 | KOH | $C_2H_4$ | 70% | 77 |
| $Cu_2O$ NPs | −1.1 | $KHCO_3$ | $C_2H_4$ | 57.3% | 87 |
| $Cu_2O$ with {100} and {111}facets | −1.1 | $KHCO_3$ | $C_2H_4$ | 59% | 26 |
| $CuO_x$-Vo | −1.4 | $KHCO_3$ | $C_2H_4$ | 63% | 91 |
| $Cu_2O$/ILGS | −1.15 | $KHCO_3$ | $C_2H_4$ | 31.1% | 99 |
| Branched CuO NPs | −1.05 | $KHCO_3$ | $C_2H_4$ | 70% | 92 |
| oxide-derived copper | −0.8 | $KHCO_3$ | $C_2H_4$ | 65% | 107 |
| $Cu_2O$ films | −0.8 | KOH | $C_2H_4$ | 67% | 100 |
| $Ag_1$-$Cu_{1.1}$ | −1.1 | $KHCO_3$ | $C_2H_4$ | 40% | 124 |
| CuZn alloy | −1.1 | $KHCO_3$ | $C_2H_4$ | 33.3% | 130 |
| $Cu_3N$ NCs | −1.6 | $KHCO_3$ | $C_2H_4$ | 60% | 111 |
| CuAg alloys | −0.7 | KOH | $C_2H_4$, EtOH | 60%, 25% | 121 |
| GO-$VB_6$-Cu | −0.25 | $KHCO_3$ | EtOH | 56.3% | 75 |
| Cu GNC-VL | −0.87 | $KHCO_3$ | EtOH | 70.52% | 18 |
| Cu-N-C | −1.2 | $CsHCO_3$ | EtOH | 55% | 112 |
| Ag/Cu | −0.67 | KOH | EtOH | 41% | 17 |
| Au-bipy-Cu | −0.9 | $KHCO_3$ | $CH_3CHO$ | 25% | 135 |
| reconstructed Cu | −0.68 | $KHCO_3$ | $C_{2+}$ | 84% | 70 |
| CuI | −0.9 | KI，$KHCO_3$ | $C_{2+}$ | 80% | 82 |
| self-supported copper-based GDEs | −0.6 | KOH | $C_2$ | > 40% | 98 |
| $Cu_2O$ nanocavities | −0.61 | KOH | $C_{2+}$ | 75.2% ± 2.7% | 94 |
| $Cu_2O/Cu$ | −0.9 | $KHCO_3$ | $C_2$ | 64.5% | 105 |
| PAN-Cu | −1.07 | $KHCO_3$ | $C_{2+}$ | 76.73% | 109 |
| $CuO_x$ | −1.0 | $CsHCO_3$, CsI | $C_{2+}$ | 69% | 90 |
| copper nanoparticle ensembles | −0.75 | $KHCO_3$ | $C_2$−$C_3$ | 50% | 52 |