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Impact of thermal annealing onto CO electroreduction at mesoporous Cu electrodeposits

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Kanan's research group [1] recently discovered a catalyst that can produce significant amount of EtOH and AcO^- (among other products) by electroreduction of carbon monoxide. Indeed, using copper derived from copper oxide, up to 57% Faradic efficiency was reached for EtOH and AcO^- at potential as low as -0.3 V *vs RHE*. The major reactions occurring during CO reduction are given by the following equations:

$$2CO + 3H_2O + 4e^- \rightarrow \mathrm{CH_3CO_2^-} + 3\mathrm{OH^-},\ E^0 = 0.50V$$

$$\mathrm{2CO + 7H_2O + 8e^- \rightarrow CH_3CH_2OH + 8OH^-},\ E^0 = 0.18V$$

Cu is the only catalyst making appreciable amounts of hydrocarbons [2,3]. So, based on Kanan's work, mesoporous Cu structures were synthetized through electrodeposition followed by different annealing processes. The catalysts were then tested for CO reduction.

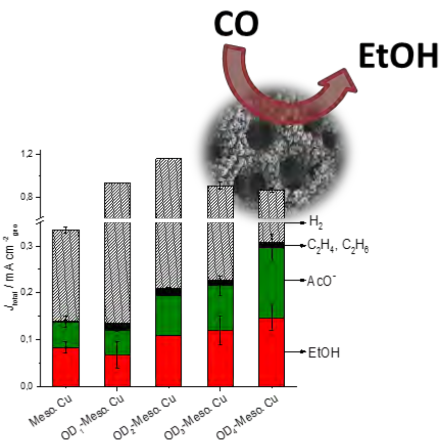

Figure. Comparison of partial current density performed in 0.1 M KOH saturated with CO at -0.25V vs RHE

[1] C. W. Li, J. Ciston, and M. W. Kanan. Electroreduction of carbon monoxide to liquid fuel on oxide-derived nanocrystalline copper. *Nature*, 2014, 508: 504-507.

[2] J. Qiao, Y. Liu, F. Hong, and J. Zhang. A review of catalysts for the electroreduction of carbon dioxide to produce low-carbon fuels. *Chem. Soc. Rev*, 2014, 43: 631-675.

[3] K. P. Kuhl, E. R. Cave, D. N. Abram, and T. F. Jaramillo. New insights into the electrochemical reduction of carbon dioxide on metallic copper surface. *Energy Environ. Sci.*, 2012, 5: 7050-7059.