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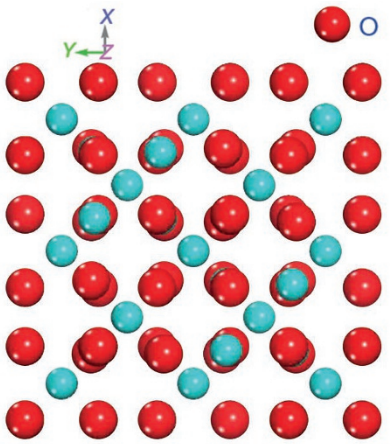
IN BRIEF

HETEROGENEOUS CATALYSIS

Small layers give big results



Adapted from Gao, S. et al. (2016), Macmillan Publishers Limited

Carbon dioxide is notorious for its inertness. It binds to surfaces only very weakly, has high thermodynamic stability and a high kinetic barrier to electroreduction, such that efforts to transform this combustion product into value-added materials come with substantial challenges. Furthermore, the variety of possible reduction products (carbon monoxide, formate, methanol and methane, among others) complicates the desirable, selective conversion of carbon dioxide into a pure fuel stream.

Yi Xie, Yongfu Sun and colleagues at the University of Science and Technology of China prepared atomically thin cobalt layers in order to effect the selective carbon dioxide electroreduction to formate. Described in *Nature*, their catalyst of choice is a four-atom-thick cobalt layer, grown by means of a ligand-confined strategy using *N*,*N*-dimethylformamide and n-butylamine. Surprisingly, these sheets contained patches of oxidized cobalt that proved crucial to the selective production of formate. Only the partially oxidized sheets, rather than pure cobalt metal or bulk cobalt, could give rise to the high selectivities (90%) observed even at mild (240 mV) overpotentials.

This work is of practical relevance because of the high abundance of cobalt, the simplicity of the nanomaterial synthesis and the electrochemical setup. The thin material could be used as a coating in an electrolyser to harvest electrons from water and reduce carbon dioxide in the accompanying half-reaction. Alternatively, one might coat a photoelectrode with the catalyst sheets and let light drive the chemistry in much the same was as photosynthesis. The synergy between oxidized and reduced cobalt in selective, electrocatalytic carbon dioxide reduction in this material will require further study in order to tease out the mechanisms at play.

Adam Weingarten, Associate Editor, Nature Communications

ORIGINAL ARTICLE Gao, S. et al. Partially oxidized atomic cobalt layers for carbon dioxide electroreduction to liquid fuel. *Nature* **529**, 68–71 (2016)

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