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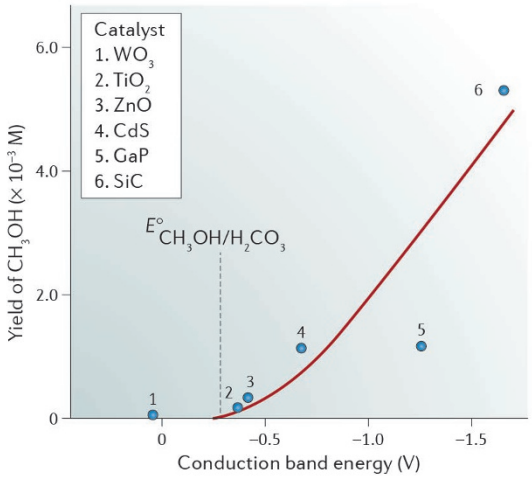
IN BRIEF

HETEROGENEOUS CATALYSIS

Powdered photocatalysts split carbon dioxide



Adapted from Inoue, T. et al. (1979), Macmillan Publishers Limited

The combustion of fossil fuels has spurred some of the most rapid human progress seen in hundreds of years, but at the price of pollution and encroaching climate change. Carbon dioxide is the most stable form of carbon in our atmosphere, binding only weakly to most surfaces and being ostensibly unreactive. Nevertheless, these troublesome properties have not stopped research efforts targeted at transforming the gas into usable, alternative forms of carbon.

In a classic study published in *Nature*, Honda and colleagues at the University of Tokyo found that suspending common semiconductors in water and illuminating the resulting mixtures results in the photoreduction of carbon dioxide to formic acid, formaldehyde, methanol and methane. A far-reaching and satisfyingly intuitive observation was reported: only semiconductors with conduction bands higher in potential than the redox couple between carbon dioxide and the desired product will perform the transformation.

The four decades following this initial study have seen the scientific community realize that carbon dioxide photoreduction is more complicated than simply considering these energetics. Indeed, substrate binding strength, pH, solubility and nanostructure are some of the many additional factors that determine how a material can react with carbon dioxide. Honda's work does have its limitations: most of the semiconductors used have low activities and are only active when illuminated by ultraviolet light, which comprises a small component of the solar spectrum. However, this proof-of-concept study forms the basis of many of our present efforts towards efficient reduction of carbon dioxide.

Adam Weingarten, Associate Editor, Nature Communications

ORIGINAL ARTICLE Inoue, T. et al. Photoelectrocatalytic reduction of carbon dioxide in aqueous suspensions of semiconductor powders. *Nature* **222**, 637–638 (1979)