DMNS FAIR

Queens College, City University of New York
Division of Mathematics and Natural Sciences
Faculty Achievement In Research

MY NAME: Harry Gafney

MY DEPARTMENT: Chemistry

SOMETHING INTERSTING ABOUT ME (OPTIONAL, MAY BE LEFT BLANK):

MY RESEARCH (IN SIMPLE WORDS THAT CAN BE UNDERSTOOD BY ANYONE ON THE Q64 BUS):

Photoinduced reduction of CO_2 by H_2O, an eight electron, four proton process, occurs in nanoporous Vycor glass doped with tungsten oxides derived from physisorbed $W(CO)_6$. In polished forms of Vycor, 312-nm photolysis yields monoclinic WO_3 and its absorption spectrum limits light absorption and photocatalytic activity to $\leq$350-nm light. In unpolished Vycor, however, 312-nm excitation of physisorbed $W(CO)_6$ yields photochromic tungsten oxide and/or bronze, which exhibit lower energy absorptions, and excitation of these lower energy transitions with $\geq$437-nm light drives the conversion. The photochromic catalyzes the conversion of a formic acid-like species derived from the chemisorption of CO_2 onto the silica surface. The dependence of methane yield on surface pH, excitation intensity, and the energetics of the conversion challenge the current band-gap model, where a single photon promotes a single electron, which is thought to diffuse to a removed reaction site. Instead, we propose thye conversion occurs by an excited-state acid-base process. Unlike the band-gap model, excitation of the photochromic changes local acidity and basicity thereby allowing the reduction of chemisorbed CO_2 and oxidation of chemisorbed H_2O to occur exergonically. The photochromic metal oxide is not the source of reducing equivalents *per se*, but by changing the local acidity and basicity, a conduit of electrons and protons between two exergonic processes.

MY RESEARCH IN 140 CHARACTERS (OPTIONAL, MAY BE LEFT BLANK):

Artificial Photosynthesis. How to accomplish it with one photon of visible light.