Abstract

Square planar d8-electron and octahedral d6-electron 2nd and 3rd row transition metal complexes are particularly promising candidates for multiredox catalysts. At the core of this reactivity are cooperative two-electron transfer events coupled to bond-making and bond-breaking steps. The cooperativity arises from the stability of the d6- and d8-electron configurations with respect to the intermediate d7-electron configuration, which can be expected to manifest as an inversion of the one-electron reduction potentials: E1°'(d7/d8)>E2°'(d6/d7). Fine control over these redox potentials and electron-transfer kinetics is a critical element of a strategy for improving catalysts and rationally designing new catalysts. However, attempts to investigate the thermodynamics and kinetics of these electron-transfer reactions are severely hampered by the fact that these reactions are often irreversible because of the accompanying drastic changes in the metal coordination sphere. To address this problem, we have designed a series of platinum and palladium complexes that undergo cooperative, outer-sphere and reversible two-electron transfer. In the course of these studies, we also have discovered materials that respond to chemical vapors, as well as aqueous ions, by changing color and luminescent properties. In this presentation, we will describe our investigations of two-electron transfer reagents, as well as how closely related compounds can be used in the detection of chemical vapors or aqueous ions.

Biography

Bill Connick is a Professor of Chemistry at the University of Cincinnati and Director of the Center for Biosensors & Chemical Sensors. He is a physical-inorganic chemist with research interests in inorganic photochemistry, catalysis, chemical sensing, radiochemistry, and nuclear forensics. After earning his B.A. degree from Williams College in 1988, he studied for two years at the University of Cambridge where he obtained a M.A. degree in chemistry. In 1997, he earned his Ph.D. degree at the California Institute of Technology with Professor Harry Gray investigating the spectroscopy, photophysics, and photochemistry of platinum(II) diimine complexes. He subsequently took a postdoctoral appointment in the laboratory of Professor Rich Eisenberg at the University of Rochester, where he synthesized and characterized metal complexes for catalyzing light-to-chemical energy conversion reactions. In 1998, he joined the faculty at the University of Cincinnati. He studies light-to-chemical energy conversion, develops new materials for chemical sensing and works with a collaborative team on the development of methods for identifying the origin of nuclear materials. He has received a Beckman Young Investigator Award (2001-2004) from the Arnold and Mabel Beckman Foundation and a National Science Foundation CAREER Award (2002-2007) for his research focused on cooperative two-electron transfer reactions. He was named an IUPAC Young Observer in 2009, the Cincinnati Section of the American Chemical Society Chemist of the Year in 2014, and Visiting Scholar at the Université de Bordeaux in 2015.