

***Towards water splitting into O₂ and H₂.
Electrochemical studies of Mn and Co
complexes***

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Professional Career

Nov 2008: Associate Scientist, (CR1) Laboratoire d'Electrochimie Moléculaire, University Paris-Diderot Paris 7.

2000-2008: Associate Scientist, (CR1) Laboratoire de Chimie Inorganique, ICMMO, University Paris-Sud 11, Orsay.

1997-1999: Visiting Scientist at Pr. K.Hodgson's Laboratory, Stanford University, and at Pr.M. Klein's Laboratory, Lawrence Berkeley Laboratory, USA.

1994-1997: Associate Scientist, (CR1) Laboratoire de Chimie Inorganique, ICMMO, University Paris-Sud 11, Orsay.

1992-1994: Associate Scientist, (CR2) Laboratoire d'Electrochimie et de Photoélectrochimie, University Paris-Sud 11, Orsay (Pr. L. Nadjo).

1991 : PhD in Molecular Electrochemistry (Pr J.-M. Savéant and Dr. D. Lexa), Laboratoire d'Electrochimie Moléculaire University Paris 7.

Research

The photosynthetic oxidation of water is one of the most important biochemical processes occurring in the biosphere, since it not only converts solar energy into chemical energy, but it is also the source of dioxygen in the atmosphere. It takes place at the catalytic center of Photosystem II, namely the Oxygen Evolving Centre (OEC), in which the energy of sunlight drives the oxidation of water ($2\text{H}_2\text{O} \rightarrow \text{O}_2 + 4\text{e}^- + 4\text{H}^+$). The catalytic site OEC consists of a Mn_4OxCa cluster, and probably a chloride ion while water molecules, oxo/hydroxo bridges, and organic cofactors make up the coordination sites around the manganese ions. Our research interests concern functional modeling of OEC. Our goal is to better understand how OEC works and more specifically to address the basic problem of removing electrons and protons from water, a process that remains poorly understood at a molecular level. Our original approach involves the design, characterization and study of the electrochemical oxidation of mononuclear Mn-bound water complexes with the aim of generating high-valent mononuclear manganese-oxo derivatives, species that are indeed predicted as intermediates in the process leading to the formation of the O—O bond. The possible involvement of CPET in the water oxidation process is investigated through a series of reactions coupling electron loss to proton removal from water. We are also interested in the catalytic production of dihydrogen through reduction of protons. We are investigating the electrocatalysis of proton reduction with non-noble metal coordination complexes (Co, Ni). Our investigation centers on intermediate species characterization and mechanistic studies.