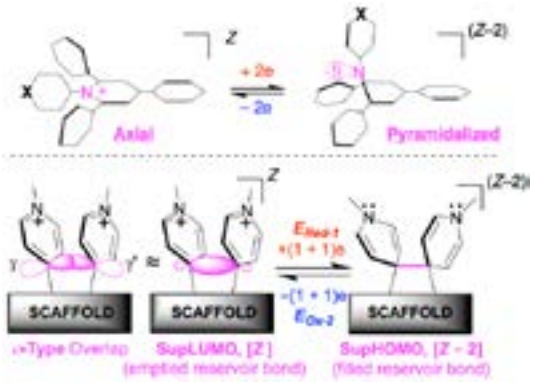
Philippe P Lainé, Mod Chem Appl 2017, 5:3(Suppl)
DOI: 10.4172/2329-6798-C1-005

5th Global Chemistry Congress

From single-electron processes to multi-electron handling and storage at the molecular level: designing super-electrophores for the next generation of prototypes of transducers for man-made photosynthesis?

Philippe P Lainé[1]
Paris Diderot University, France

As part of our continuing research program devoted to artificial photosynthesis, which relies on multi-photon and multi-electron processes, we have recently revisited the physical chemistry, and especially the electrochemistry of pyridinium derivatives as multi-electron acceptors. Here we report on the design and rich electrochemistry of two classes of super-electrophores that share the uncommon feature of being able to undergo a two-electron reduction in a single step. The functioning of these super-electrophores relies on the intriguing phenomenon of potential inversion which can be implemented in different ways that actually correspond to two different electrochemical paradigms. On the one hand, there are polyaryl-substituted pyridiniums referred to as branched Expanded Pyridiniums (EPs), that are multifunctional platforms featuring good electrophoric properties and also effective chromophoric and luminophoric activities. On the other hand, there are specifically assembled multi-electrophoric compounds, referred to as Structronic Assemblies (SAs), characterized by their electrochemical hysteresis, that allow the storage of electrons in the form chemical bonds used as electron reservoirs. Special emphasis is herein placed on the rationalization of electrophoric properties and the mechanisms that explain the unusual electrochemical behavior of these two classes (EPs & SAs) of super-electrophores. These studies combine various experimental methods (crystallography, NMR, electrochemistry as well as *in situ* UV-vis. and IR spectro-electrochemistry) with theoretical modeling. Finally, the manner by which these types of super-electrophores (EPs & SAs) could be used within the framework of research devoted to man-made photosynthesis will be evoked.



Biography

Philippe P Lainé has been trained as a Chemist at University Pierre et Marie Curie (UPMC) Paris, France. After his PhD and Post-doctorate degree, he became Research Assistant at CNRS (University Paris-Sud, Orsay and University Paris Descartes, Paris) and then CNRS Research Director at University Paris Diderot (ITODYS Lab.). His research interests span from Molecular Electronics to Solar Energy Conversion and Storage. His expertise is in Molecular Chemistry, Supramolecular and Bio-Inorganic Photochemistry as well as Molecular Electrochemistry. His current research activity is devoted to molecular and supramolecular transduction for energy and information.

philippe.laine@univ-paris-diderot.fr

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