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IMCN SEMINAR

Towards rechargeable batteries made of abundant chemical elements

Wednesday 29 April 2020 – 11:00 am
Auditoire J.-B. Carnoy (B059)
Croix du Sud, 4-5, 1348 Louvain-La-Neuve

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ABSTRACT

Li-ion batteries (LIBs) appear nowadays as flagship technology able to power an increasing range of applications starting from small portable electronic devices to advanced electric vehicles. Over the past two decades, the discoveries of new metal-based host structures coupled with substantial technical developments have considerably improved their electrochemical performances, particularly in terms of energy density. Nevertheless, to further promote the electrochemical storage systems while limiting the demand on metal-based raw materials, one possible parallel research to inorganic-based batteries consists in developing organic electrode materials. Indeed, organic systems exhibit several advantages such as chemical structures composed of quite naturally abundant elements (*e.g.*, C, H, N or O) and a great richness in terms of chemical designs. For a long time, this class of redox-active materials has been disregarded mainly due to stability issues but, in recent years, progress has been made demonstrating that organics undeniably exhibit considerable assets. Great achievements have already been realized especially with organic radical batteries (ORBs). However, simultaneously achieving high energy/power density and high cyclability in a fully integrated organic Li-ion cell is still challenging. For the past few years, our group has been revisiting selected organic structures containing pi-conjugated enolate/C=O-based moieties in order to identify robust organic electrode structures reacting at both high and low potentials vs. Li. This contribution will be an opportunity to present some interesting organic materials showing reversible electrochemical activities at the solid state as well as recent advances in terms of poorly soluble organic cathode materials capable of being reversibly charged at a high enough potential.

BIOGRAPHY

Philippe Poizot is currently a Professor of Chemistry at University of Nantes (Institut des Matériaux Jean Rouxel, IMN-CNRS, Nantes, France), and has been working on electrochemical systems for the past 20 years. After a Master of Science in Analytical Chemistry (University of Paris VI, 1998), he obtained his Ph.D. degree in Materials Science (2001) focused on “conversion reactions” under the guidance of J.-M. Tarascon at the University of Picardy Jules Verne (UPJV-LRCS) in Amiens, France. During his Ph.D., he showed that numerous simple 3-d metal oxides and others can reversibly react with large amounts of Li through what we call now a “conversion reaction”. He joined Switzer’s group (University of Missouri-Rolla, USA) in 2001 as postdoctoral fellow to develop the electrodeposition of nanostructured materials and enantiospecific catalysts. He became Associate Professor in Chemistry in 2002, joined the University of Picardie Jules Verne (LRCS, Amiens, France). In 2007, he proposed the concept of “renewable” batteries by promoting novel electrode materials based on redox-active organic compounds deriving from biomass.

In 2012, he was appointed as full Professor at University of Nantes (Institut des Matériaux Jean Rouxel, IMN-CNRS, Nantes, France). His current research topics are mainly focused on rechargeable batteries, molecular electrochemistry, and the development of organic batteries in both aqueous and nonaqueous electrolytes. He is a recipient of the Bronze Medal of the French Society for Encouragement and Progress (2002) and was a Junior Fellow of the Institut Universitaire de France (2012−2017). He is author of more 80 publications and co-inventor of 10 patents.

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