

Development of Non Polymeric Positive Electrode Materials for Rechargeable Organic Batteries

Philippe Poizot^{a,b}, Élise Deunf^a, Pablo Jiménez^a, Philippe Moreau^a, Éric Quarez^a, Franck Dolhem^{c,d}, Dominique Guyomard^a

^a *Institut des Matériaux Jean Rouxel (IMN), CNRS-Université de Nantes, 2 rue de la Houssinière 44322 Nantes Cedex 3, France*

^b *IUF, 103 bd Saint-Michel, 75005 Paris Cedex 5, France*

^c *Laboratoire de Glycochimie, des Antimicrobiens et des Agroressources (LG2A), CNRS-Université de Picardie, 33 rue Saint-Leu, 80039 Amiens Cedex*

^d *Réseau sur le Stockage Electrochimique de l'Energie (RS2E), FR CNRS 3459, France*
email address of the presenting author: philippe.poizot@cnsr-immn.fr

Most of traditional batteries are based on the redox chemistry of inorganic species (mainly metals), of which some are scarce natural resources, often costly (even toxic) and energy greedy at the process level. Alternatively, organic chemistry provides great opportunities for finding innovative electrode materials and developing potentially greener electrochemical storage systems. Based on the tailoring of naturally abundant chemical elements (*e.g.*, C, H, N, O), organics give the true possibility of being prepared from renewable resources and eco-friendly processes. Additionally, a better recycling management is expected for such batteries because organic compounds can thermally be eliminated with possible heat recovery. Last but not least, two types of electrochemical mechanisms can be used in practice: n-type structures with cations release/uptake and p-type structures with anions uptake/release.

These last ten years, significant progress has been achieved on redox-active organics bringing them positively to the attention of the energy storage community as demonstrated by the rapid increase in the number of studies and recent reviews on the topic [1]. However, the search for efficient organic electrode materials is still a burgeoning field and one of the most challenging tasks remains the fabrication of long lasting and high energy organic batteries.

For the past few years, we have been revisiting selected n-type organic structures based on carbonyl/carboxyl functional groups and identified stable redox-active organic structures able to reversibly accommodate lithium. For instance, efficient lithiated positive electrode materials have been developed [2]. Beyond this class of organic materials, this contribution will be more importantly focused on the development of novel p-type non polymeric compounds able to intercalate anions at average operating potentials > 3.2 V vs. Li^+/Li giving rise to organic electrode materials exhibiting higher energy densities.

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[2] S. Renault, S. Gottis, A.-L. Barrès, M. Courty, O. Chauvet, F. Dolhem, P. Poizot, *Energy Environ. Sci.* 6 (2013) 2124–2133; S. Gottis, A.-L. Barrès, F. Dolhem, P. Poizot, *ACS Appl. Mater. Interfaces* 6 (2014) 10870–10876.