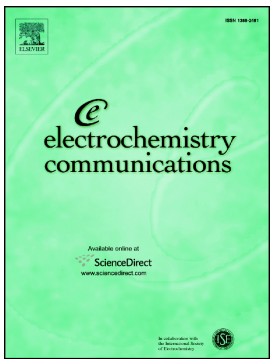

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Tracking ionic fluxes in porous carbon electrodes from aqueous electrolyte mixture at various pH

Yih-Chyng Wu,[1,2] Pierre-Louis Taberna,[1,2] Patrice Simon[1,2*]

[1]*Université Paul Sabatier, CIRIMAT UMR CNRS 5085, 118 route de Narbonne, 31062 Toulouse, France*
[2]*Réseau sur le Stockage Electrochimique de l'Energie (RS2E), FR CNRS 3459, France*

***** *Corresponding author at: CIRIMAT, Université de Toulouse, CNRS, INPT, UPS, 118, Route de Narbonne, 31062 Toulouse cedex 9, France.*
E-mail address: simon@chimie.ups-tlse.fr (P. Simon)

Abstract

Electrochemical quartz crystal microbalance (EQCM) and cyclic voltammetry (CV) techniques were used to study ion dynamics in porous carbide-derived carbon (CDC) electrodes in various aqueous electrolytes. Although the cyclic voltammetries look similar, EQCM revealed different ion transfer depending on the electrolyte during both positive and negative polarization. During polarization in neutral K_2SO_4 electrolyte, partial desolvation of cation and anion were observed in carbon micropores. **In EMI^+-HSO_4^- electrolyte, the main charge carrier during cation adsorption was not found to be bulkier EMI^+, but smaller and highly mobile H^+.** Furthermore, ionic fluxes during charging/discharging were monitored and identified in multi-ions aqueous system, which was ambiguous according to the CV plots. EQCM shows its powerful ability to serve as an accurate gravimetry probe to study the electrolyte concentration and compositional changes in porous materials.

1. Introduction

The development of modern societies highly relies on energy.[1] One of the promising energy storage devices is electrochemical double layer capacitors (EDLCs), also known as supercapacitors.[2–4] In EDLCs, high capacitance can be reached by using high specific surface area active porous carbon materials for charging the electrochemical double layer capacitance.[5–9]

Carbide derived carbons (CDCs) have been one of the most attractive model materials for EDLC applications because of tunable pore size and narrow pore size distribution.[10–14] Significant research works have revealed that the capacitance increased dramatically when the carbon pore size was decreased below the solvated ion