

3<sup>rd</sup> International Conference on

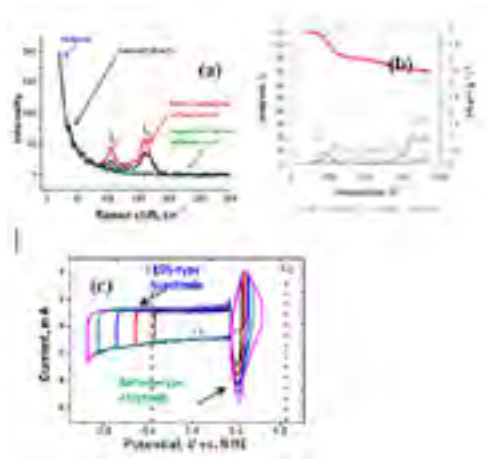
# ELECTROCHEMISTRY

July 10-11, 2017 Berlin, Germany

## Iodides confinement within activated carbon porosity resulting battery-type electrode for aqueous hybrid supercapacitor

Qamar Abbas, Patryk Przygocki, Paulina Babuchowska and Francois Beguin  
Poznan University of Technology, Poland

Supercapacitors (SCs) generally use activated carbon (AC) electrodes and organic electrolytes e.g. 1 mol L<sup>-1</sup> TEABF<sub>4</sub> in acetonitrile due to the energy vs. voltage square dependence. However, due to the flammable character of acetonitrile, environment-friendly and low cost alternatives e.g. neutral aqueous Li<sub>2</sub>SO<sub>4</sub> (pH=6.5-7.0) exhibiting moderate voltages up to 1.5 V in SCs have been recently proposed. Such voltage exceeding water stability of 1.23 V is due to large over-potential for di-hydrogen evolution at the negative carbon electrode caused by local downshift of pH. Lately, by introducing potassium iodide (KI) in aqueous Li<sub>2</sub>SO<sub>4</sub>, AC/AC hybrid cells operating up to 1.6 V displayed high capacitance as a result of hybridization of a battery-type positive electrode and capacitor-type negative one. The battery-type performance of the positive electrode is associated with redox reactions  $2I^- \leftrightarrow I_2 + 2e^-$  enhancing greatly the capacity of the positive electrode than for the negative one,  $C_+ \gg C_-$ , and using equation for capacitors in series  $1/C = 1/C_+ + 1/C_-$  capacitance of cell is equal to negative electrode capacitance. Here, we show that hybrid capacitors in aqueous KI+Li<sub>2</sub>SO<sub>4</sub> (pH=6.5) using symmetric carbon configuration losses capacitance upon cycling/floating at 1.5 V. When using microporous carbons as positive and negative electrodes, the former reaches to +0.692 V vs. SHE, and when implementing mesoporous electrodes, the negative electrode reaches to -0.985 V vs. SHE well below the di-hydrogen evolution potential (-0.46 V vs. SHE). Hence, both systems display capacitance loss under cycling/floating at 1.5 V. We implement asymmetric configuration using mesoporous carbon as positive electrode to better trap iodide species, and microporous carbon as negative one to improve hydrogen storage, to balance the system. TPD, Raman, gas adsorption and electrochemical data on electrodes and cells (Figure 1) proves that the oxidation of positive electrode and hydrogen production on negative electrode are reduced, improving the cyclability, capacitance and energy efficiency of the cell up to 10,000 cycles.



### Biography

Qamar Abbas received his PhD degree in Technical Sciences from Graz University of Technology (Austria) in 2011. From 2011-2015, he did his Post-doctoral studies from the Institute of Chemistry and Technical Electrochemistry (ICTE) at Poznan University of Technology, Poznan, Poland. Since 2016, he is an Assistant Researcher at the ICTE and his research interests are related with optimization of supercapacitor performance in aqueous and organic electrolytes under testing conditions and corrosion investigations and mitigation of stainless steel type alloys in aqueous media.

qamar.abbas@put.poznan.pl