

“Current collectors surface treatments for carbon supercapacitors in organic electrolytes”

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Carbon-carbon electrochemical double layer capacitors are power devices exhibiting intermediate performances between batteries and capacitors [1]. This high-power capability is linked to the energy storage process, achieved by reversibly charging/discharging the double-layer capacitance through ion adsorption.

One of the key points in these high-power system is the cell series resistance, that must be as low as possible. This resistance is the sum of various contribution, including electrolyte resistance, active layer intrinsic resistance and active material/active layer resistance contact.

A surface treatment of Al current collectors has been achieved in order to decrease the impedance contact between the Al current collector / active material interface. It consists in a two-step treatment. First, an Al foil is chemically etched in an acidic solution at 80°C after degreasing in NaOH 1M solution. This step creates a surface porosity on the Al foil, as can be seen in Figure 1. Second step consists in a coating, via the sol-gel route, of the Al foil surface by a conducting carbonaceous material [2]. Figure 2 presents the Al surface after the coating process. It can be seen that the particles covers the whole Al surface.

Supercapacitors laboratory cells have been assembled with treated Al current collectors, in an acetonitrile + NEt_4BF_4 1;5M and cycle at constant current between 0 and 2.3V. The results show improved performances as compared to untreated Al foils. Specific resistance of 0.5 ohm.cm^2 have been obtained, with constant value over the 10,000 cycles studied, as it is presented in Figure 3. This low series resistance, associated with a specific capacitance of 95 F/g of active material, make this supercapacitor electrodes suitable for high-power applications.

References :

[1] : B.E. Conway in “Electrochemical Capacitor: Scientific: Fundamentals and Technological applications”, Plenum Press, New York (1999).

[2] : C. Portet, P.L. Taberna, P. Simon and C. Laberty Electrochem. Acta, 49 (2004) 905-912.

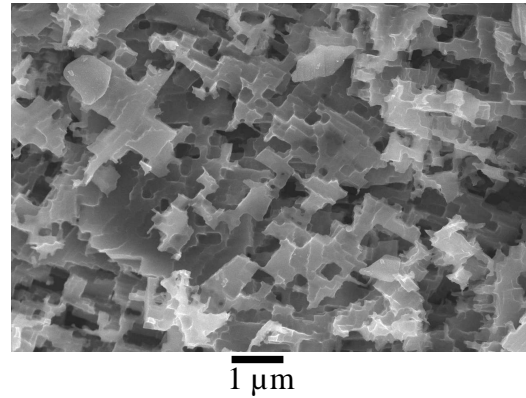


Figure 1: SEM-FEG picture of an etched Al foil surface.

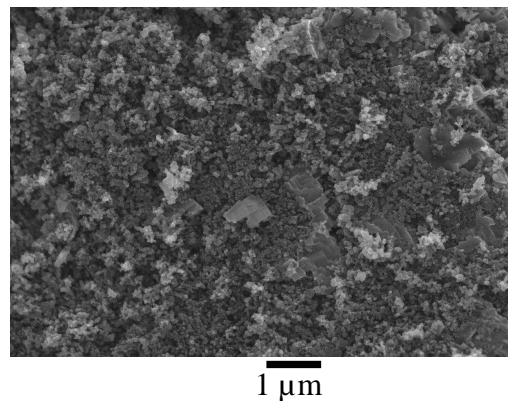


Figure 2: SEM-FEG picture of an etched Al foil covered by a carbonaceous foil

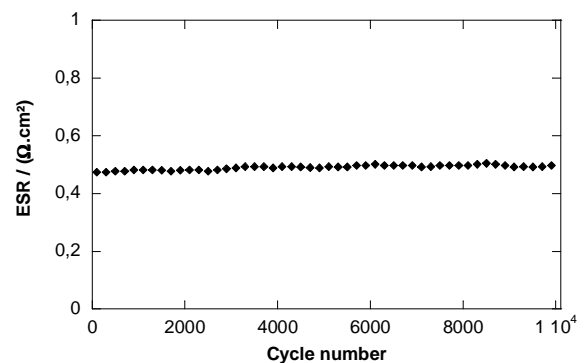


Figure 3: Change of the series resistance on 10,000 cycles between 0 and 2,3V for a cell using treated-Al collectors.