Selecting a membrane for supercapacitor batteries with water-based electrolyte

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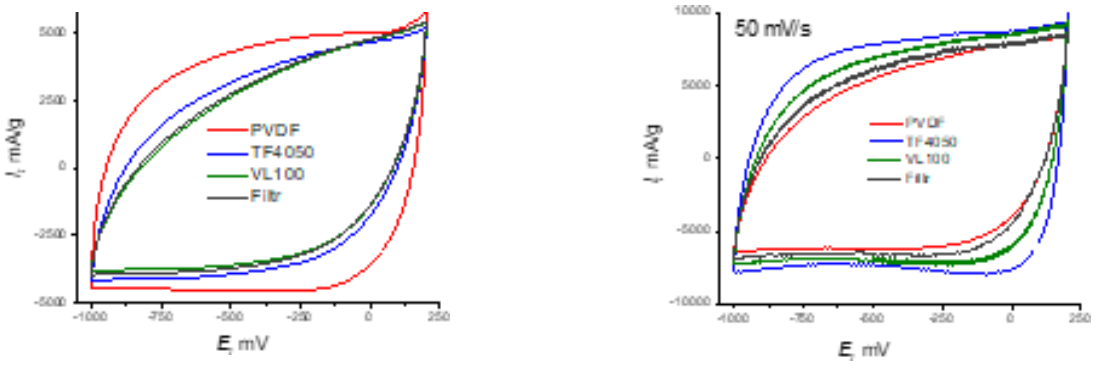
One of the important parts of the energy storage system is a separator, which has the function of separating the anode from the cathode. Despite the wide variety of existing materials, there are

still ongoing developments to improve membrane properties such as: ionic conductivity, high porosity, chemical and electrochemical stability in the electrolyte, as well as the thickness of the material. This study analyzes new materials courtesy of Nippon Kodoshi Corporation (pulp-and-paper separator TF4050 and VL100; Japan) and compares them with hydrophilic membrane filter made of PVDF (Durapore, Germany) and Whatman quality filter paper, Grade 1 (Whatman, UK).



a) b)

Figure 1 –CV curves in saturated a) LiCl and b) $NaClO_4$ electrolyte (scan rate is 50 mV/s).

Comparison was done by CV measurements (from 1 to 100 mV/s) using galvanostat/potentiostat Biologic SP-300. Cyclic voltammetry was provided on different membranes in saturated LiCl (14 M) and $NaClO_4$ (8.5 M) electrolytes where MXene, Carbon-cloth and Ag/AgCl were chosen as working, counter and reference electrode respectively. At low scan-rate (1-5 mV/s) there is no difference between CV shapes, since there are no limitations on membrane nature, however, on a higher scan rate, starting from 10 mV/s, the CV area as well as sweep angle differences can be noticed significantly. According to this, TF4050 based membranes have best response with $NaClO_4$ electrolyte and good response with LiCl electrolyte for kinetic properties which is very important for MXene type supercapacitor-electrode materials, where specific power is an important factor and requires fast charge-discharge abilities (or high scan rate).

For farther investigation of membrane properties for possible application in water-based electrolyte batteries and supercapacitors is necessity to check impedance spectroscopy and to evaluate mechanical properties of membranes. At this moment, investigated membranes are very suitable for this application.