Performance of Activated Carbon Fiber Electrodes for Electric Double Layer Capacitors

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Electric double layer capacitors (EDLCs) have been interested for the application on hybrid electric sources for EV and others. For these application, high power type is expected and EDLCs with aqueous solutions are one of prospective candidates. In this work, we estimated the performance of activated carbon fiber electrodes for positive and negative electrodes of EDLCs in aqueous HCl solutions containing some other electrolytes. The capacitance, time-potential relation, self-discharge, leak current, etc. were measured and favorable results were obtained.

The activated carbon fiber clouth was supplied by Toyobo (BW554) and the BET surface area was about 1130m^2/g and the amount of acidic groups on the surface was 1.65 mmol/g. The current collector was a platinum plate. A beaker type cell with there electrodes cell was used. The apparent surface area of the test electrode was 1 cm^2 and that of Pt counter electrode was 9.8 cm^2. The reference electrode was SCE. Electrolytic solutions were aqueous HCl solutions containing some other electrolytes, HClO, H_3PO_4 and / or $LaCl_3$.[1)] On the measurement of capacitance, the potential ranges applied were 0.55～0.85V vs. SCE for the positive electrode and 0.05～0.35V vs. SCE for the negative electrode. The charge-discharge performance of positive and negative electrode, the influence of co-existed ions, and other characteristics of the electrodes were measured at 25℃.

Figure.1 shows the capacitance of the positive and negative electrodes in (2mol HCl + 1mol $HClO_4$ + 1/3mol H_3PO_4) / dm^3. These results show that the capacitance of the positive electrode was ca. 50F/g and that of the negative electrode was ca.80F/g higher than that in aqueous 2mol/dm^3 HCl.

These phenomena are corresponding to the difference of adsorptive ions on each electrode. At the same time, the co-adsorption and specific adsorption would affect on these results.

On the 80mA/cm^2 discharge, the positive electrode showed ca.100F/g and that of the negative electrode was ca.135F/g.

The self-discharge of the positive electrodes was smaller than that of the negative electrodes and these phenomena would be also caused by the difference of the adsorptive ions on each electrode. The results showed small leak current.

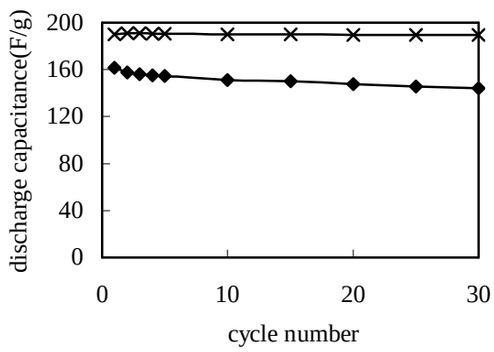

Fig.1 Discharge capacitance of positive and negative electrodes.

Electrolyte :
(2mol-HCl+1mol-$HClO_4$+1/3mol-H_3PO_4)/dm^3
Current density : 5mA/cm^2

Reference

1) Y. Matsuda, R. Tsuda and M. Mori, Electrochemistry (Old name : Denki Kagaku) 69, 473 (2001)