years since 1992, there has been intense activity both in University research, and by financial support from State Ministries in the production of electric vehicles, chargers (particularly fast-chargers) and monitoring devices for accumulators. Legislative support has started in some cities.

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PII: S0378-7753(01)00572-9

P11

Microporous carbons for supercapacitors☆

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Due to the availability of various precursors and technologically well-developed methods of modification, materials based on carbon are especially adapted for application in electrochemical capacitors. They can be used with aqueous solutions (basic and acidic) as well as in aprotic media. During the preparation of carbon material it is possible, over a wide range, to affect the microtexture and chemical composition through the selection of precursor, conditions of carbonisation and the activation process.

The method used to prepare the carbon determines the electrochemical parameters of a capacitor. Generally, the most convenient is to use carbon materials in the fibrous form, however in our case the powdered carbon obtained from petroleum coke and then chemically activated supplied high capacitance values of over 200 F g^{-1}. Specific surface area of this carbon, as measured by nitrogen gas adsorption at 77 K, was approximately 2800 m^2 g^{-1}.

Electrochemical parameters of the investigated material, which was in the form of a pellet comprising 85% of C, 10% of PVDF and 5% of AB, were determined in the two electrode 'swagelok' cell as described elsewhere [Frackowiak et al., Appl. Phys. Lett. 77 (2000) 2421–2423] using 6 M KOH and 1 M H_2SO_4 electrolytes. Specific capacitance was calculated from voltammetry characteristics at scan rates from 1 to 10 mV s^{-1}, galvanostatic cycling with current densities from 50 to 1000 mA g^{-1} and impedance spectroscopy in the range from 1 mHz to 100 kHz. Electrochemical investigations were carried out using a multichannel potentiostat/galvanostat (VMP Biologic, France) and a Solartron SI 1260. All the techniques gave comparable results of specific capacitance of carbon (approximately 270 F g^{-1} in alkaline solution and approximately 230 F g^{-1} in acidic medium).

The results obtained show that alkaline electrolyte is preferable for this type of carbon when used as capacitor material. During voltammetry experiments from 0 to 0.8 V, the shape of the characteristics remains perfectly rectangular even at the fast scan rates (10 mV s^{-1}). Only in the wider range of potential (from 0 to 1.0 V) does the shape of voltammograms change slightly, but the stored charge remains the same and galvanostatic characteristics are still linear. This means that carbon material allows quick charge propagation. This is also confirmed by impedance spectroscopy (material supplies a high capacitance of over 120 F g^{-1} at 1 Hz). This is a proof that the carbon material, apart from having a well-developed surface area, possesses the required porosity from the presence of mesopores. In acidic solution, the capacitance values are lower by about 20%, however the frequency response is better. Further investigations are planned to correlate microtexture, pore size, distribution of pores and chemical composition of carbon with capacitance parameters for aqueous as well as aprotic electrolyte solutions.

☆This research was financially supported by NATO grant SfP 973849

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PII: S0378-7753(01)00719-4

P12

Lead film electrodes as both negative and positive plates of a lead-acid battery

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As has been shown previously, the electrochemical characteristics of lead film electrodes may be significantly influenced by the materials and shape of metallic substrates. Lead layers were deposited by the currentless, contact-exchange method from a molten salt electrolyte onto pure and technical grade smooth aluminium plates and grids 300–700 μm thick and onto copper grids 100–150 μm thick.