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Electrochemical Behavior of Supercapacitor Electrodes Based on Activated Carbon and Fly Ash

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The possibility of applying fly ash from power plants as a binder in supercapacitor electrodes based on activated carbon was investigated in this research. Based on the mechanical and electrical properties of the electrodes, the optimal ratio between fly ash and AC was determined. Supercapacitor electrodes were prepared in two ways: by pressing and by laser solidification. The preparation method significantly affected physical properties of the electrodes as well as the electrochemical behavior in supercapacitor setup. The electrodes were electrochemically tested by galvanostatic and potentiostatic methods and cyclic voltammetry. In order to improve the estimation of supercapacitor parameters, mathematical model that perfectly describes the behavior of investigated electrodes in aqueous solution of sodium nitrate was developed. The best results were obtained with laser-solidified electrode in 1M aqueous solution of $NaNO_3$. Specific capacitance of 105 F/g, serial resistance of 0.57 Ω and self-discharge resistance of 95 Ω were achieved. Stability at high number of cycles proved to be very good. After 2000 cycles of CV at scan rate of 100 mV/s, specific capacitance fell by only 4.6 %.

Keywords: supercapacitors; activated carbon; fly ash; laser solidification; $NaNO_3$

FULL TEXT