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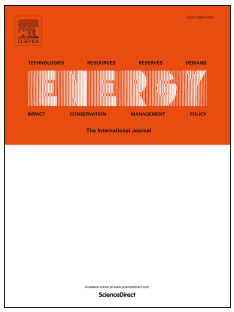

Self-discharge of a hybrid supercapacitor with incorporated galvanic cell components

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Self-Discharge of a Hybrid Supercapacitor with Incorporated Galvanic Cell Components

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Abstract:

Supercapacitors can provide a high specific power and long cycle life but suffer a significant self-discharge limiting their application as a stand-alone energy storage device. A new hybrid supercapacitor with incorporated galvanic cell components was proposed to mitigate the self-discharge problem. The hybrid supercapacitor was similar to a conventional supercapacitor with two active carbon electrodes separated by a polymer electrolyte membrane containing 1.5 M zinc sulfate. However, a zinc foil and a copper foil were used as the current collectors for the negative and the positive electrodes respectively, which can provide a micro-current to compensate the self-discharge current. The hybrid supercapacitor exhibited a maximum specific capacitance of 55 F g^{-1} and specific energy of 4.51 Wh kg^{-1} with a charge efficiency of 90%. The capacitance retention of the hybrid supercapacitor was 80% after 2000 cycles. The open circuit voltage of the charged hybrid supercapacitor was stable and declined slightly from initial 0.90 V to 0.85 V in a month. The results demonstrate that via replacement of a pair of conventional metal current collectors with a galvanic couple the ubiquitous self-discharge problem can be significantly mitigated and the storage time can be prolonged to meet the