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ABSTRACT BOOK

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Alginate-derived activated carbon hybridized with NiMn2O4 for use in supercapacitors

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Abstract:

Transition metal oxides (TMOs) are promising materials because of their specific properties enabling their application in energy solutions, such as their pseudocapacitive behavior enabling utilization as electrode materials in supercapacitors. Activated carbon is a material well known as an electric double layer capacitor (EDLC). Bringing together the two different capacitor materials- TMOs as pseudocapacitors and carbon materials as EDL capacitors is the goal for generating future generation supercapacitors.

Nickel manganite is a material of interest because of various oxidation states of manganese which provide its reactivity in oxidoreduction reactions, enhancing the pseudocapacitive behavior. Herein, we synthesized nano-sized nickel manganite by a sol-gel combustion synthesis process using glycine as fuel and subsequent calcination process. The structure and morphology of synthesized material was investigated via XRD, FESEM, and FTIR spectroscopy. Specific surface area and was determined from measured nitrogen adsorption/desorption isotherms. Activated carbon was obtained by pyrolytic carbonization of alginate hydrogel in nitrogen atmosphere and activation with KOH. The material was combined with synthesized $NiMn_2O_4$ nanopowder and tested as supercapacitor electrode. The second alternative was incorporating $NiMn_2O_4$ powder into alginate hydrogel, followed by pyrolysis in nitrogen atmosphere to obtain a $NiMn_2O_4$ -activated carbon composite. The obtained materials were electrochemically characterized with cyclic voltammetry (LV) and galvanostatic chronopotentiometry to get galvanostatic charge-discharge curves. We calculated high specific capacitance values ranging to several hundred F/g, showing our hybrid material is a promising electrode in a supercapacitor system.