Influence of Freezing Methods on the Supercapacitor Performance of Doped Carbon

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Herein, doped carbon materials are synthesized from biomass utilizing facile microwave irradiation for supercapacitor application. Lignosol is used as a carbon precursor while ammonium polyphosphate is utilized as a doping agent as well as microwave absorber. The amount of doping agent is changed to tune the nitrogen and phosphorus doping concentration in the resulting carbon materials. To further enhance the materials' physical characteristics such as enhancement of the material's porosity and surface area that consequently improve their specific capacitance, the freeze pore method is utilized. The freeze-pore approach is simply the freezing of material in the presence of water to exploit expansion properties of water in freezing state to attain an increase in surface area and pore size. All these materials are physically characterized in detail using X-ray photoelectron spectroscopy, scanning electron microscopy, and Brunauer-Emmett-Teller (BET) surface area analysis. Finally, the electrochemical characteristics of all materials are studied by using cyclic voltammetry in acidic and basic electrolyte. It is observed that the freeze pore approach tunes the porosity, surface functionalities, the surface area as well as the electrochemical activity of the doped carbon materials.

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