Template-free preparation of 3-D microporous carbon foam for binder-free lithium-ion battery anode

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Recently, the hierarchically porous carbon with mesoporous or microporous characteristics are attracting much attention due to their extensive applications from supercapacitor, lithium-ion batteries (LIBs), solar cells, hydrogen storage, fuel cells, and so on. Generally, the porous carbon based architectures can be obtained by the use of template-assisted carbonization methods. Herein, we synthesized the simple and bio-derived highly porous 3-D microporous carbon foam by the template-free carbonization of agarose pellet at high temperature. The effect of compression for pellet fabrication and different calcination temperature on the porosity and electrochemcial performances of the carbon foam was thoroughly investigated. Interestingly, the porousity of the resulted carbon foam was varied based on the changing the pressure and temperature. Among the carbon foams, the highest surface area of 415.8 m^2g^{-1} and microporous surface area of 362 m^2g^{-1} were obtained for the pellett fabricated at 11 MT and carbonization at 10 °C min^{-1} to 650 °C. Due to excellent porous characteristics of the carbon foam electrode, it deleivered the high specific capacity and excellent rate capabilty in LIB electrode.