Influence of the pore texture of carbon xerogels on their behavior as anodes for Li-ion batteries

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In current Li-ion batteries, graphite remains the most used anode material, but higher values of capacity could be attained with hard carbons owing to their 3D porous architectures. Such materials however suffer from high irreversible losses during the first charge-discharge cycle and the influence of porosity on this behavior still remains an open debate. This study aims at determining which textural parameters could explain some observed electrochemical behaviors. For that purpose, carbon xerogels are extremely interesting since their textural parameters can be independently controlled and tailored through the synthesis conditions.

All parameters such as micropore volume, particle sizes and E-C testing conditions have been kept constant in order to isolate the sole influence of the meso- or macropore texture on the electrochemical behavior. A clear relationship could be established between the external surface area of the carbon xerogels nodules and the charge/discharge capacities. The in-depth textural characterization of the active material-binder composite has also shown that the presence of the binder in the electrode strongly affects the measured micropore volume.

To study the influence of microporosity, two conditions were required: (i) the use of an electrode preparation method allowing to preserve the micropore texture of the materials and (ii) techniques to specifically modulate the micropore fraction (CO_2 activation and CVD coatings). A relationship was found between the specific surface area of the powders and their E-C behavior. More importantly, is has been shown that the electrochemical tests conditions could strongly affect the conclusions regarding the performances of porous hard carbons.