Porous carbon and its nanocomposites for energy storage applications

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Carbon cryogels with controlled porous structure and surface chemistry were synthesized through sol-gel processing. Metal or metal oxide nanoparticles were homogeneously dispersed throughout the porous carbon matrix through solution impregnation. Both porous carbon and its nanocomposites have been studied for energy storage applications. Three examples will be used to illustrate how the porous structure, surface chemistry, and dispersed nanoparticles affect energy storage properties. The first example is the influence of surface chemistry on the capacity of carbon electrodes used in supercapacitors. The second example is the application of carbon cryogel – oxide nanocomposites in lithium ion batteries. The last example will be methane storage in carbon cryogels. These examples demonstrate that the appropriately designed and fabricated porous carbon and nanocomposites possess greatly enhanced energy storage capacity through the synergistic combination of surface chemistry and nanostructures of the constituent phases.