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3D Carbon Structures (Globugraphite) with Hierarchical Pore Morphology for the Application in Energy Storage Systems

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Abstract : Three-dimensional carbon materials can be used as electrode materials for energy storage systems such as batteries and supercapacitors. Fast charging and discharging times are realizable without reducing the performance due to aging processes. Furthermore high specific surface area (SSA) of three-dimensional carbon structures leads to high specific capacities. One newly developed carbon foam is Globugraphite. This interconnected globular carbon morphology with statistically distributed hierarchical pores is manufactured by a chemical vapor deposition (CVD) process from ceramic templates resulting from a sintering process. Via scanning electron (SEM) and transmission electron microscopy (TEM), the morphology is characterized. Moreover, the SSA was measured by the Brunauer–Emmett–Teller (BET) theory. Measurements of Globugraphite in an organic and inorganic electrolyte show high energy densities and power densities resulting from ion absorption by forming an electrochemical double layer. A comparison of the specific values is summarized in a Ragone diagram. Energy densities up to 48 Wh/kg and power densities to 833 W/kg could be achieved for an SSA from 376 m^2/g to 859 m^2/g. For organic electrolyte, a specific capacity of 100 F/g at a density of 20 mg/cm^3 was achieved.

Keywords : BET, carbon foam, CVD process, electrochemical cell, Ragone diagram, SEM, TEM
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