Porous, Hyper-cross-linked, Three-Dimensional Polymer as Stable, High Rate Capability Electrode for Lithium-Ion Battery

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ABSTRACT:

Organic materials containing active carbonyl groups have attracted considerable attention as electrodes in Li-ion batteries due to their reversible redox activity, ability to retain capacity, and, in addition, their ecofriendly nature. Introduction of porosity will help accommodate as well as store small ions and molecules reversibly. In the present work, we introduce a mesoporous triptycene-related, rigid network polymer with high specific surface area as an electrode material for rechargeable Li-ion battery. The designed polymer with a three-dimensional (3D), rigid porous network allows free movement of ions/electrolyte as well as helps in interacting with the active anhydride moieties (containing two carbonyl groups). Considerable intake of Li^+ ions giving rise to very high specific capacity of 1100 mA h g^{-1} at a discharge current of 50 mA g^{-1} and ∼120 mA h g^{-1} at a high discharge current of 3 A g^{-1} are observed with excellent cyclability up to 1000 cycles. This remarkable rate capability, which is one of the highest among the reported organic porous polymers to date, makes the triptycene-related rigid 3D network a very good choice for Li-ion batteries and opens up a new method to design polymer-based electrode materials for metal-ion battery technology.

KEYWORDS:

Dihydroanthracene succinic anhydride (DASA)

Hyper-cross-linking, porous 3D rigid polymer

Li-ion battery, organic electrode material