Porphyric complex as self-conditioned electrode material for high performance energy storage

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ABSTRACT
Herein we report the use of the novel functionalized porphyrin [5,15-Bis(ethynyl)-10,20-diphenylporphinato]copper(II) (CuDEPP) as electrodes for rechargeable energy storage systems with extraordinary combination of storage capacity, rate capability, and cycling stability. The ability of CuDEPP serving as an electron donor or acceptor supports various energy storage applications. Combined with a lithium (Li) negative electrode, the CuDEPP electrode exhibits a long cycle life of several thousand cycles and fast charge-discharge rates up to 53 C. A specific energy density of 345 Wh kg\(^{-1}\) at a specific power density of 29 kW kg\(^{-1}\) can be achieved. Coupled with a graphite cathode, CuDEPP anode delivers a specific power density of 14 kW kg\(^{-1}\). While the capacity is in the range of ordinary Li ion batteries, the CuDEPP electrode has a power density in the range of supercapacitors, opening the pathway for new organic electrodes with excellent rate capabilities and cyclic stabilities.

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