Biobased Polymer Cathodes with Enhanced Charge Storage

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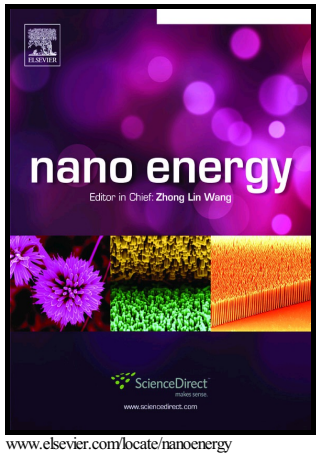

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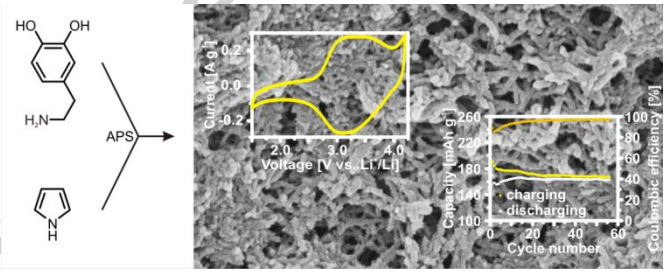
While increasing worldwide energy consumption demands for better storage devices, the environmental impact of these is often neglected. More sustainable energy storage in terms of greener battery materials would be desirable. In this regard, bioderived quinone containing molecules may serve as active battery material. Here, dopamine, among others an important neurotransmitter or active in mussel adhesion, is copolymerized with pyrrole to form a rod-like mixed copolymer. n-type charge storage in the quinone functionalities is combined with p-type charge storage in the conjugated doped polymer backbone from pyrrole and dopamine units with decreased polaron delocalization length compared to neat polypyrrole. The resulting sustainable polymer can be used as a cathode material due to a favorable redox potential of approx. 3.0-3.5 V vs. Li^+/Li. It can reversibly store 160 mAh g^{-1} at a discharging rate of 100 mA g^{-1} and hence achieve similar capacities than inorganic, unsustainable, cathode materials and significantly higher capacities than other sustainable cathodes. Capacity is stable for more than 50 cycles, and even at high discharging rate of 800 mA g^{-1}, approximately 90 mAh g^{-1} are reversibly stored with coulombic efficiency of almost 100 %.

Graphical Abstract:



Keywords:

dopamine, nanofibrille, organic battery, charge storage, copolymer, sustainable chemistry