Long Life High Energy Density K+/FSI- Dual-ion Battery with Corncob/Graphite Mixture as Cathode and Soft Carbon as Anode

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Currently, most lithium ion batteries use metal oxides as cathodes, which makes them toxic, expensive and difficult to recycle. In contrast, dual ion batteries utilize only carbon as cathode and anode. They are easy to recycle. Potassium is much more abundant than lithium. To protect the environment and reduce cost, potassium ion batteries are under active development. In this study, an environmentally friendly, recyclable, low cost, safe and fast charging nonaqueous K+/FSI- dual-ion battery (PDIB) was successfully developed with soft carbon as anode and graphite(graphite mine)/hard carbon(carbonization of corncob) mixture as cathode. The new cathode can intercalate and adsorb FSI- ions simultaneously. By combining the advantages of potassium ion batteries and supercapacitors, the new cathode achieved a capacity of 97 mAh g-1 at 500 mA g-1. And the new anode exhibited high capacity (about 200 mAh g-1 at 2000 mA g-1) and long cycle life (9000 cycles with almost no decay). The full K+/FSI- dual-ion battery with the new cathode and anode showed a high energy density of 146 W h kg-1, a high power density of 599 Wh kg-1, and a long cycle life of 2000 cycles. This study demonstrates great potential to apply this recyclable, low cost, safe and fast charging PDIB for energy storage systems. The abundant potassium and carbon resource can meet the ever increasing demand for new, safe & low cost energy storage solution. Future research will focus on the continuous improvement of energy density for this new battery.

Awards Won:

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