Polyimide as anode electrode material for rechargeable sodium batteries

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The sodium battery has the potential to be the next generation rechargeable system which utilizes cheaper and more abundant sodium material but affords nearly the same power as lithium batteries. One of the key barriers for the sodium battery is the lack of stable anode materials with sufficient redox capacity and cycling stability. This contribution reports the sodium insertion in a kind of polyimide which was synthesized by 1,4,5,8-naphthalenetetracarboxylic dianhydride (NTCDA) and ethylene diamine (EDA). The resulting polyimide (PI) has been characterized by XRD, TGA and IR. The cyclic voltammetry (CV) and charge–discharge tests are carried out at room temperature. PI shows discharge specific capacity above 140mAhg$^{-1}$ and excellent cyclability with less than 10% degradation in the first 500 cycles (fig.b and fig.c). The Na insertion mechanism was proposed (fig.a) and about 1.2 V full sodium batteries were made and cycled reversibly.

Figure. Structure and Electrochemical Performance of PI.
(a) structure of PI.
(b) Charge/discharge curves for the Na/PI battery. Electrolyte 1M NaClO$_4$-EC/DEC(1:1).
(c) Galvanostatic cycling of PI electrode. Cycling rate:1C.