Exceptionally high capacity cathode and Full Cell Study on Sodium-ion Battery

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Sodium-ion battery (SIB) has attracted great interest to the energy storage application for its low cost and uniform distributions in the earth crust. However, SIB technology is in a premature state and needs more impactful research to make it commercialized. Sodium-ion has larger ionic size than lithium and needs a wider open framework to accumulate the larger ion during the intercalation-deintercalation process. Herein, a high energy density (~650 Wh kg^{-1}), high rate capable doped-ammonium vanadium oxide (NVO) cathode material is studied. This cathode delivers a high specific sodium discharge capacity of ~ 212 mAh g-1 at a high current rate of 0.5 A g^{-1} with the high Coulombic efficiency of 99.8%. It also exhibited 99.9 % capacity retention after 50 cycles at a very high current rate of 2 A g^{-1}. A sodium-ion full cell was demonstrated with this cathode against hydrogenated sodium titanium oxide (NTO) anode. The full-cell showed a capacity to provide 467 Wh kg-1 energy density even at a very high rate of 0.2 A g^{-1} and showed a real-life application in a LED-based table lamp. The results showed the current sodium-ion full cell prototype is one of a promising candidate for large-scale energy storage system in future.

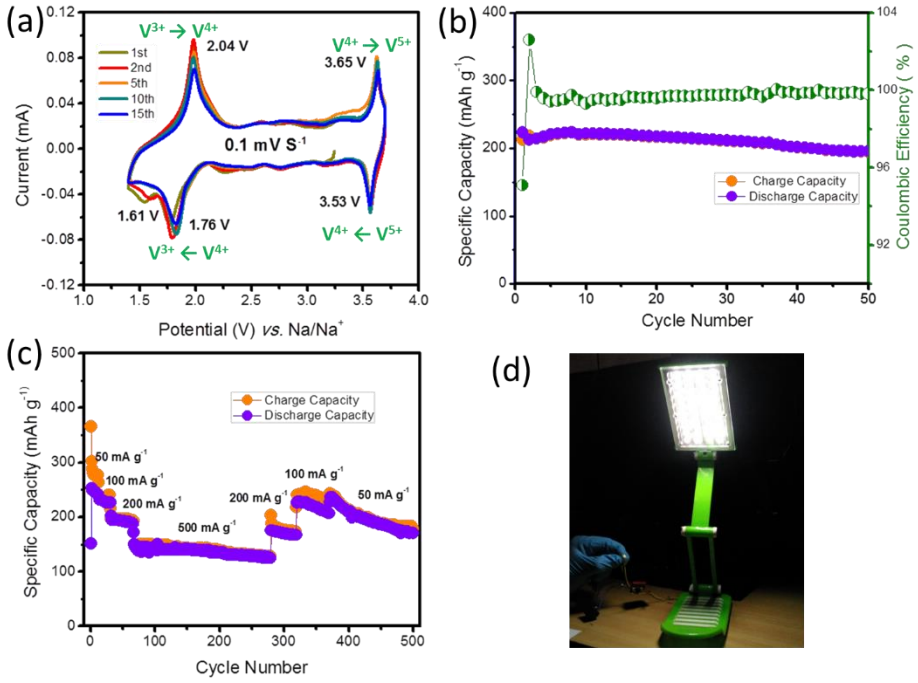

Figure 1. (a) CV of NVO cathode at 0.1 mV s^{-1} scan rate, (b) Cycling performance of NVO cathode at 0.5 A g^{-1} current rate, (c) Rate performance of SIB full cell made of NVO cathode and NTO anode and (d) Demonstration of SIB full cell prototype application in an LED-based table lamp.

References:

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