An ultrafast rechargeable aluminium-ion battery

With the support by the National Natural Science Foundation of China and Scholarship Council, Dr. Lu Bing'an at the School of Physics and Electronics, Hunan University, under the guidance of Professor Dai Hongjie of Stanford University, co-reported a rechargeable aluminium battery with high-rate capability, which was published in *Nature* (2015, 520: 324—8).

The development of new rechargeable battery systems could fuel various energy applications, from personal electronics to grid storage. We have developed a new Al-ion battery using aluminium metal as anode and graphite as cathode. The battery operates through the electrochemical deposition and dissolution of aluminium at the anode, and intercalation/de-intercalation of chloroaluminate anions in the graphite, using a non-flammable ionic liquid electrolyte. When a flexible 3D graphitic foam is used as cathode, the Al/graphitic-foam cell could be charged and discharged at a current density of 4000 mA g^{-1} (equivalent to 3000 W kg^{-1}), to withstand more than 7500 cycles without capacity decay.

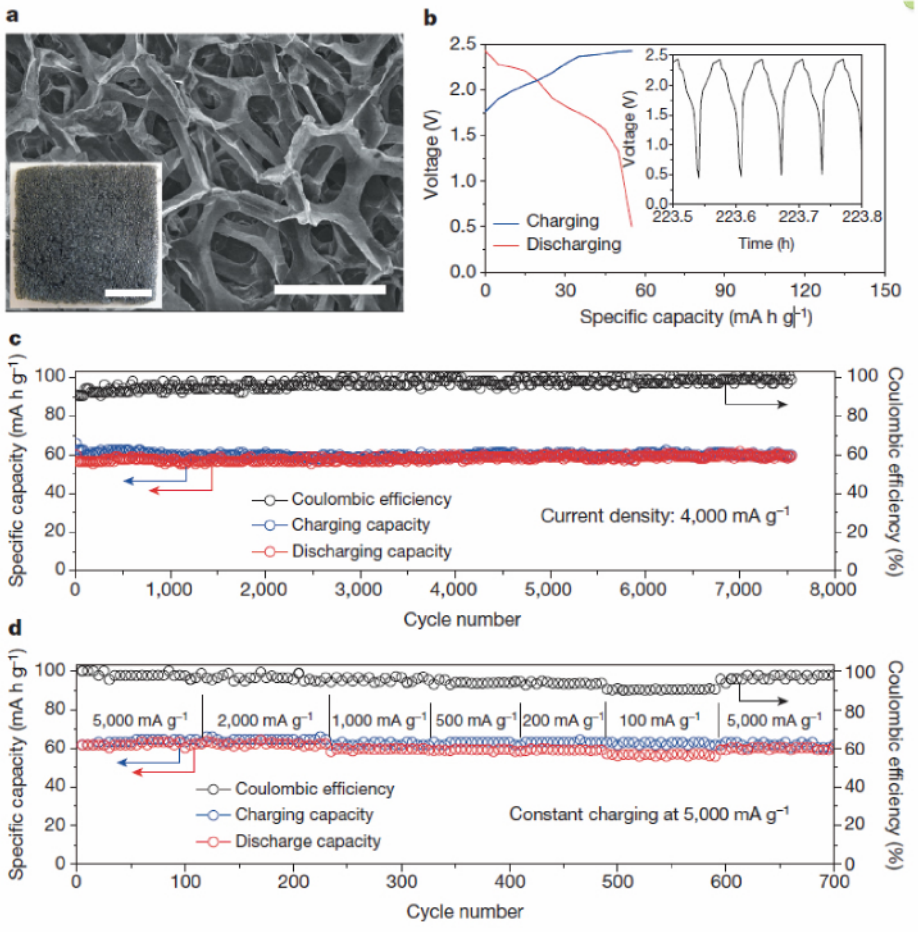

Figure An ultrafast and stable rechargeable Al/graphite cell. a, A SEM image showing a 3D graphitic foam with an open frame structure; scale bar, 300 mm. Inset, photograph of the 3D foam; scale bar, 1 cm. b, Galvanostatic charge and discharge curves of an Al/graphitic-foam pouch cell at a current density of 4000 mA g^{-1}. c, Long-term stability test of an Al/graphitic foam pouch cell over 7500 charging and discharging cycles at a current density of 4000 mA g^{-1}. d, An Al/graphitic-foam pouch cell charging at 5000 mA g^{-1} and discharging at current densities ranging from 100 to 5000 mA g^{-1}.