A high-capacity Li-rich cathode material with a single-layer Li2MnO3 superstructure

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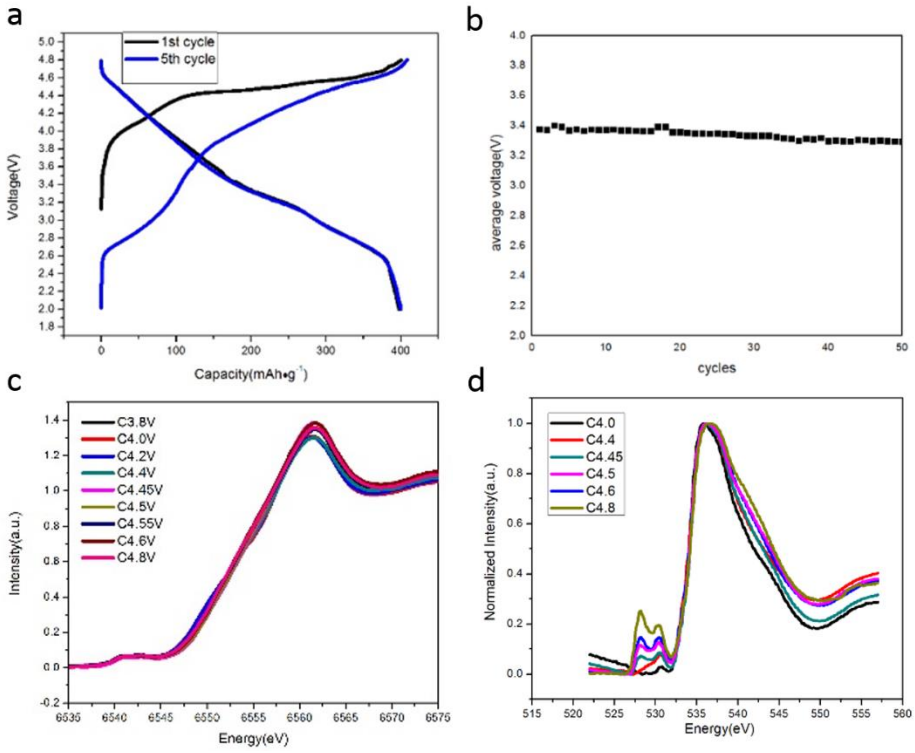
High capacity cathode is the key to the realization of high energy density lithium ion batteries. The anionic oxygen redox induced by activation of the Li_2MnO_3 domain has previously afforded an O3-type layered Li-rich material used as cathode for lithium-ion batteries with a notably high capacity of 250–300 mAh g^{-1}. However, its practical application in lithium-ion batteries has been limited due to electrodes made from this material suffering severe voltage fading and capacity decay during cycling. Here, we show that an new-type Li-rich material with a single-layer Li_2MnO_3 superstructure can deliver an extraordinary reversible capacity of 400 mAh g^{-1}. The activation of a single-layer Li_2MnO_3 enables stable anionic oxygen redox reactions and leads to a highly reversible charge–discharge cycle. Understanding the high performance will further the development of high-capacity cathode materials that utilise anionic oxygen redox processes.



Typical voltage–capacity profile obtained at a rate of 10 mA g^{-1} for a cut-off voltage of 2.0–4.8 V. b) Plot of average discharge potential versus cycle number at a rate of 80 mA g^{-1}. c). Absorption spectra of normalised Mn K-edges at different charge voltages. d) Absorption spectra of O K-edges at different charge voltages.