Mitigating voltage decay of Li-rich layered oxide by introducing 5d-metal Rhenium

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Lithium-rich manganese based layered oxides, with high operational voltage and high practical capacity, have attracted much attention in the past decade for their potential to be an alternative to the current commercial cathode electrodes for the next generation Li-ion batteries. But further development has so far been constrained by their drawbacks such as poor cycle life, gradual voltage decay and disappointing rate performance.

Herein, a strategy to promote the electrochemical performance of this material by introducing 5d-metal rhenium to the surface is developed. As-prepared $Li_{1.2}Ni_{0.13}Co_{0.13}Mn_{0.52}Re_{0.02}B_{0.02}O_2$ shows better stability of O-O dimer in the highly delithiated state compared with pristine $Li_{1.2}Ni_{0.13}Co_{0.13}Mn_{0.54}O_2$. As a result, the modified cathode exhibits a mitigated average dischage voltage decay of 0.58V decrease after 250 cycles at 200mA·g^{-1} which is 0.93V for the pristine material. In addition, it also shows higher cycling stability of over 200mAh·g^{-1} with a capacity retention of 90% within 100 cycles and 78% within 250 cycles at 200mA·g^{-1}, and better rate performance. The improvements are correlated to the enhanced oxygen stability that originates from the tuned local structure. This facile strategy may further be extended to other high capacity electrode systems.

References:

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