Oxygen redox activity in $Na_{0.67}Ni_{0.25}Mg_{0.05}Mn_{0.7}O_2$

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Sodium-ion batteries (NIBs) are set to become vital as an environmental friendly and cost effective alternative for lithium-ion batteries (LIBs). Regardless of its lower energy density, NIBs are still attractive due to the high demand in inexpensive energy storage technology. The pursuance of high capacity cathode materials for NIBs have become crucial. Layered manganese oxide materials of the type Na-Mn-O_2 have shown promising electrochemical performances among the cathode materials for NIBs.[1] Recent studies have also reported additional capacity over the conventional transition metal redox, contributed from oxygen redox chemistry and oxygen loss in compounds such as $Na_{2/3}[Mg_{0.28}Mn_{0.72}]O_2$ and $Na_{0.78}Ni_{0.23}Mn_{0.69}O_2$.[2,3] The Mg-doped layered oxide cathode material $Na_{0.67}Ni_{0.25}Mg_{0.05}Mn_{0.7}O_2$ has been reported in former literature providing satisfactory electrochemical results in terms of energy density and rate capability.[1]

On a similar note with $Na_{2/3}[Mg_{0.28}Mn_{0.72}]O_2$ and $Na_{0.78}Ni_{0.23}Mn_{0.69}O_2$, the Mg-doped $Na_{0.67}Ni_{0.25}Mg_{0.05}Mn_{0.7}O_2$ cathode material also exhibits irreversible capacity in the first cycle (fig. 1). This study therefore aims to investigate the phenomenon of oxygen redox chemistry in the Mg-doped cathode material. Energy-tuned X-ray photoelectron spectroscopy (SOXPES/HAXPES) measurements and resonant inelastic X-ray scattering (RIXs) are used to make detailed characterisations of the material.

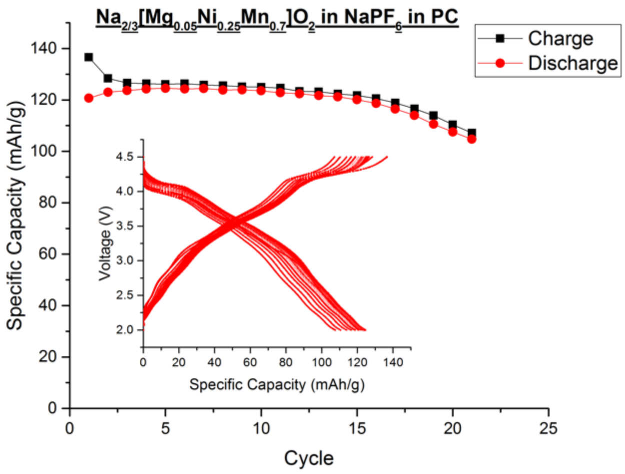

Fig. 1. Galvanostatic charge/discharge curve of $Na_{0.67}Ni_{0.25}Mg_{0.05}Mn_{0.7}O_2$

References:
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