# High Performance Nickel Oxide Anodes for Li-ion batteries

Abstract:

Since the market emergence of Li-ion secondary batteries in the 1990s, graphite has been the anode of choice. However, consumer demand for portable electronics with enhanced capabilities and longer times between recharging (i.e. laptops, tablets and smartphones), and the transition of fully-electric and hybrid-electric vehicles to lithium-ion batteries has made it clear that the energy density of future generations of lithium-ion batteries will need to be dramatically improved in order to satisfy weight and power requirements. Therefore, materials with a higher capacity than graphite must be examined. Metal oxide anode materials, such as nickel oxide, have higher theoretical capacities than graphite, but do not possess good capacity retention.

The underlying hypothesis of this work is that the poor capacity retention is caused by low electrical conductivity that is caused by the emergence of $Li_2O$ during the charging cycle of NiO ($NiO + 2Li^+ \rightarrow Ni + Li_2O$). Therefore, in this work, the effect of increasing the electrical conductivity by introducing a non-intercalating carbon to the NiO electrode on the capacity and reversibility of nickel oxide anodes for lithium ion batteries was investigated. Four different nanostructures of nickel oxide were prepared and varying percentages of carbon were added to form the anode material. The results showed that increasing conductivity resulted in higher capacity and capacity retention. However, surprisingly, it was also found that the improved capacity retention was not due to improved structural reversibility.