rGO@Se@Ni cathode materials for lithium-selenium battery

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Lithium-sulfur batteries have attracted particular interests due to its high theoretical specific capacity and energy density. The practical application of lithium-sulfur batteries is still hindered by the intrinsic drawbacks of sulfur, such as insulating nature and formation of electrolyte-soluble polysulfides. Selenium, as a congener of sulfur, has fairly analogous electrochemical properties but much higher electronic conductivity (1×10^{-3} S m^{-1} vs. 5×10^{-30} S m^{-1} of sulfur) [1-3]. Selenium also has high volumetric capacity (3253 Ah L^{-1}), comparable to that of sulfur. High electronic conductivity and high volumetric energy density make selenium a promising cathode material for lithium ion and sodium ion batteries.

In this report, selenium was electrodeposited on nickel foam from aqueous selenite solution. The resultant Se@Ni was dipped into the graphene oxide (GO) solution. GO was coated on Se@Ni through physical adsorption to produce rGO@Se@Ni. The developed rGO@Se@Ni electrode showed a high initial specific capacity of 580 mAh g^{-1} and good capacity retention over 100 cycles at 0.1 C.

This method is simple and easy to scale up. It does not need binder, conductive agent and organic N-methyl-2-pyrrolidone to make slurry and coating. Meanwhile, rGO@Se@Ni can be used in some flexible devices thanks to the flexible ability of nickel foam. This method can be further extended to other conductive substrate.

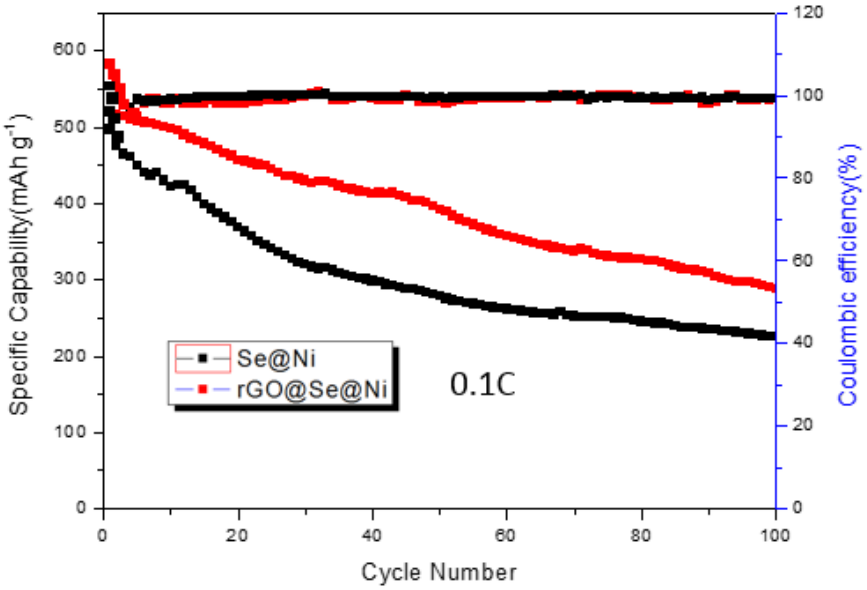

Figure 1. Cycling performance of Se@Ni and rGO@Se@Ni in Li-ion batteries at 0.1 C for 100 cycles.

References:

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