Improved performances of surface modified lithium metal anodes

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Due to the highest theoretical specific capacity and low redox potential, lithium (Li) metal battery could meet the demand of high energy density. However, high reactive and dendrite issues of Li anode restrict the development of Li metal battery. Inhibition of Li dendrite and reducing side reaction between Li anode and electrolyte are two key points to improve the performance. The modification of Li surface is of significance for its practical application.

We designed a multifunctional electrolyte additive, where KNO_3 is applied to *in situ* modify metallic Li surface in a chemical method. The K^+ cation could form a positively charged electrostatic shield to suppress Li dendrite, and simultaneously NO_3^- anion can be profitable to the reinforcement of SEI, thus the average coulombic efficiency was improved significantly from 13 to 97% as shown in Figure 1a.[1] Since the *in-situ* chemical treating method is able to stabilize SEI successfully for expanded cycling lifetime, it is very reasonable to expect that a facial physical/chemical means can *ex-situ* modify metallic Li surface effectively. To verify this speculation, we used a chemical means *ex-situ* to build an effective artificial SEI by immersing Li anode in HIO_3 solution. By using the modified Li anode in Li-S batteries, the satisfactory discharge capacities were obtained from Figure 1b. [2] In addition, the physical coating method via magnetron sputtering is also appropriate to tune Li surface condition. As shown in Figure 1c-d, amorphous Li_3PO_4 and Al_2O_3 coating layer can uniform the distribution of electric field on Li surface, resulting in even Li deposition.[3] [4]

In summary, either *in-situ* or *ex-situ* chemical/physical methods modified Li surface was verified to be effective to suppress Li dendrite for advanced performance.

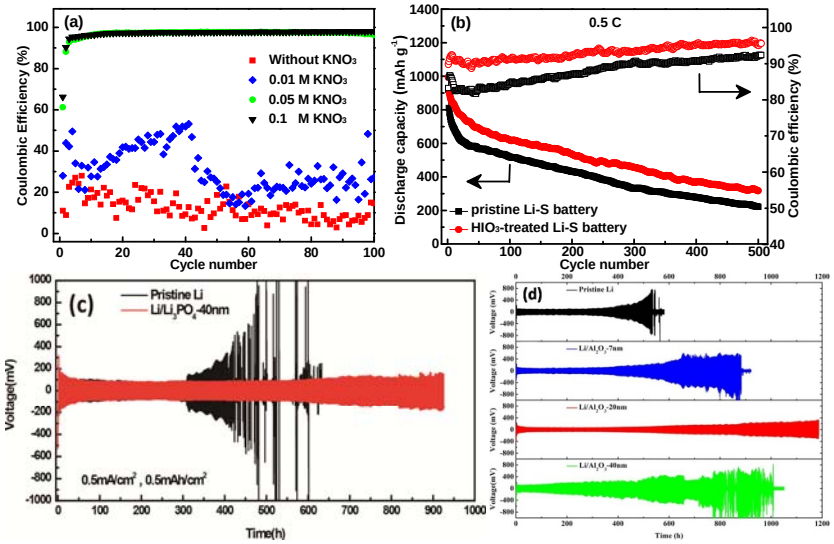

Figure 1. (a) Coulombic efficiency of Li-Cu cells of different KNO_3 concentrations. (c) Long-cycle profiles of Li-S cells with pristine Li and HIO_3-treated Li. (c) Comparison of symmetric Li-Li cells with pristine Li and Li@Li_3PO_4. (d) Voltage profiles of the symmetric Li-Li cells with different thickness Al_2O_3 film as artificial SEI layer.

References:

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