High energy density lithium batteries using solid electrolyte interface engineering

Jie Huang[a], Qi Yang[b], Wenjun Li[a, c], Qiyou Tian[a], Lei Zhang[a], Jiumin Li[a], Qun Li[a], Zheng Geng[b], Jiliang Qiu[b], Jieru Xu[b], Jiaze Lu[b], Huigen Yu[a], Qiang Zhang[c], Hong Li[a, b], Xuejie Huang[b], Liquan Chen[a, b]

[a] *Beijing WeLion New Energy Technology Co. Ltd, Beijing,102402, China*

[b] *Institute of Physics, CAS, Beijing 100190, China*

[c] *Tsinghua University, Beijing 100084, China*

E-mail: *hli@iphy.ac.cn*

High energy density lithium batteries (HELB) are highly desired by many emerging applications. Increasing energy densities of cathode materials, increasing reversible capacity, initial coulumbic efficiency and decreasing average delithiation voltage of anode materials are decisive to improve the energy density of the cell. In addition, high safety, good cyclic performance, reasonable rate performance, stable high temperature storage property, good low temperature charging performance, low volume expansion as well as low cost are also expected and have to be satisfied. Some requirements are conflicting in view of the properties of the materials. Balancing the energy density, kinetic properties and stability need special strategies. Nanosized interfacial coating, bulk doping, controlling the size and shape of the particles, fine tuning of the microstructure of the electrode are commonly applied and essential in developing HELB. In this report, our efforts on developing HELB by forming solid electrolyte interface either on particle or on electrode layer will be introduced.[1-4] Chemical deposition, electrochemical reactions, *in situ* polymerization have been introduced separately or simultaneously for fabrication HELB cells. NCM and Li-rich oxides are used as cathode active materials. Nanostructured Si anode and composite lithium anode are used as anode active materials. The hybrid solid/liquid electrolyte containing both oxide solid electrolyte and gel electrolyte is used. Based on above strategies, the 10Ah-level HELB cells with energy densities of 290-500Wh/kg and 600-1000 Wh/L have been fabricated. Detailed progresses, scientific problems and technological challenges will be reported in the meeting.

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