Practical Development of Si Anodes for Industrial Application

Sujong Chae

Over twenty years, silicon (Si) has been investigated as a promising alternative to conventional graphite because of its high specific capacity and proper working voltage. However, the huge volume change of Si (~400%) upon (de)lithiation causes severe mechanical degradation accompanying with ceaseless side reaction, rendering the application of Si anode herculean. In order to overcome the challenge of Si anode, numerous strategies such as nano-engineering, surface coating, alloy design, and etc. have been demonstrated with their improved electrochemical properties. In this seminar, in order to verify their commercial feasibility, the practical investigation of these strategies will be covered based on the cell design for full-cell configuration. Besides, the practical requirement for overcoming theoretical energy limit of conventional graphite anode will be suggested. Additionally, as a great candidate of commercially viable Si anode, I will introduce our recent work regarding the micron-sized Si/carbon composite anode synthesized by impregnation of petroleum pitch into nano-porous Si. This micron-sized Si/carbon composite from scalable synthesis provides practical solution to the challenge of Si anode, enabling very stable cycling of Si||Li(Ni0.5Co0.2Mn0.3)O2 battery with 80% capacity retention after 450 cycles.