

in-situ SEM observation of all solid lithium battery

By SEM observation of all-solid-state battery while charge and discharge, it is possible to detect the morphological changes of constituent materials and the changes of element distribution. Here, we introduce the *in-situ* observation of all-solid-state battery using sulfide-based solid electrolyte.

in-situ SEM observation

- Available under (1) inert atmosphere, (2) pressure and/or restriction to sample, (3) Voltage application (4) sample heating
- Suitable for in-situ observation for all solid state batteries
- Information of morphological and composition changes (Li insertion / desorption, etc.) can be obtained
- Possible to evaluate the same sample by Raman and TOF-SIMS

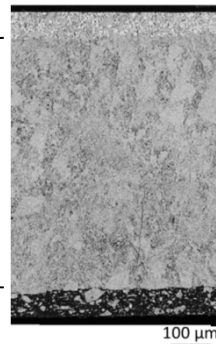
in-situ SEM observation of all solid state battery

Composition of all solid state battery

Cathode 70 μm : NCA / LGPS

SE layer 800 μm : $\text{Li}_6\text{PS}_5\text{Cl}$

Anode 100 μm : Graphite / $\text{Li}_6\text{PS}_5\text{Cl}$

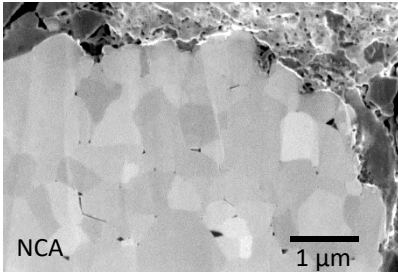


- Charge and discharge condition
0.1 C CC
- Voltage range
2.7~4.5 V

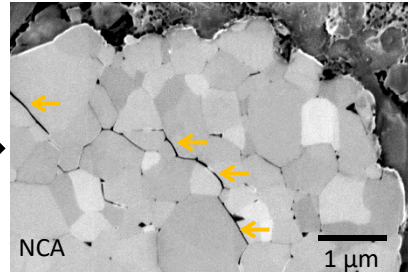
Sample was provided by Dr. Tabuchi, AIST, Japan

<Cathode>

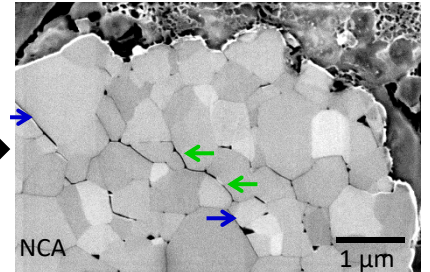
Before charge



After charge



After discharge

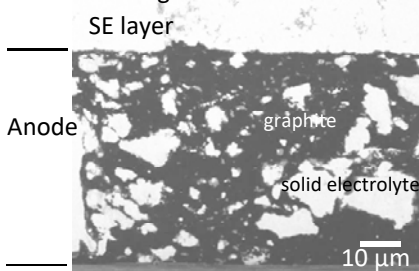


← gap inside secondary particle

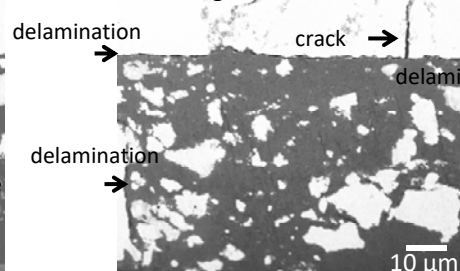
← no gap change → gap decrease

<Anode>

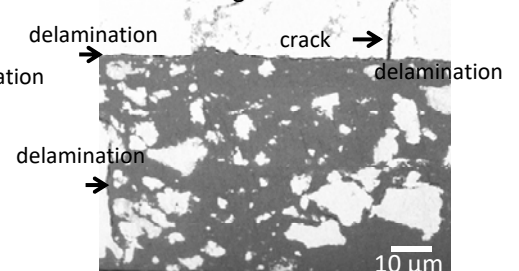
Before charge



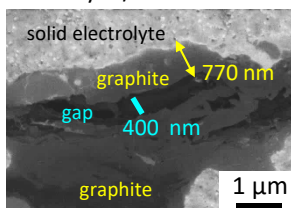
After charge



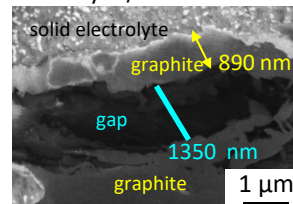
After discharge



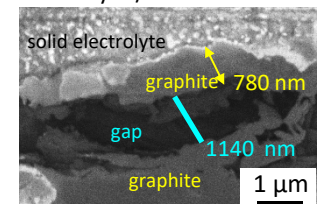
Electrolyte / Anode interface



Electrolyte / Anode interface



Electrolyte / Anode interface



Visualization of gap and crack between active material and solid electrolyte during charge / discharge process