Degradation analysis of LIB with graphite / SiO composite anode

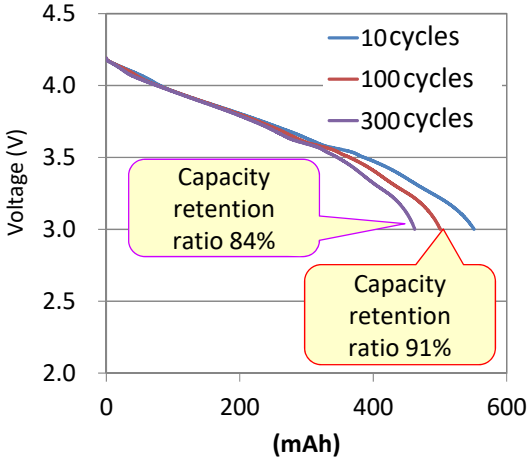
Toray Research Center can conduct test production of LIB cells and their aging tests. Here, we analyzed the LIB with graphite / SiO composite anode after cycle test and estimated the cause for the capacity fade.

Capacity change of LIB and half cell of its cathode and anode

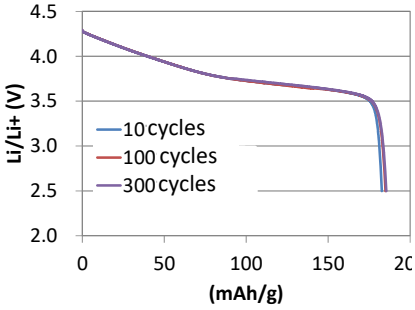
Capacity fade after cycle test

→ Capacity decreases in anode, which shows its chemical and morphological structural change

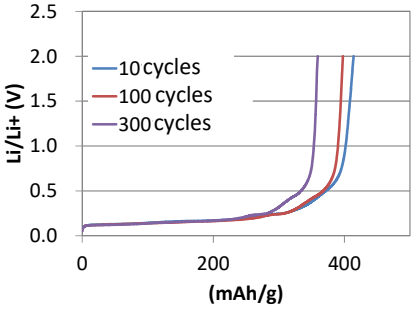
→ Capacity retention ratio of full cell (84 %) decreases greater than that of half cell (87 %), which derives from SEI formation at anode



Cathode half cell



Anode half cell



(mAh)

Cycle numbers	10	100	300
Full cell	551	500 (91%)	462 (84%)
Cathode half cell	183	185 (100%)	185 (100%)
Anode half cell	414	398 (96%)	374 (87%)

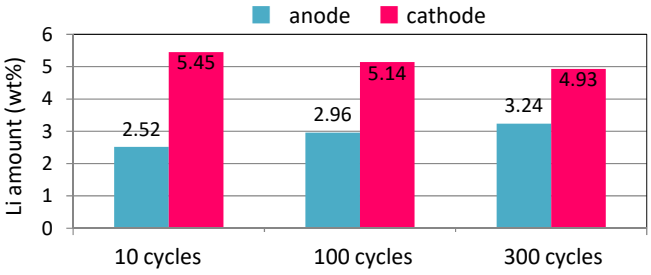
(): capacity retention ratio against 10 cycles

Li quantification of anode and its chemical state

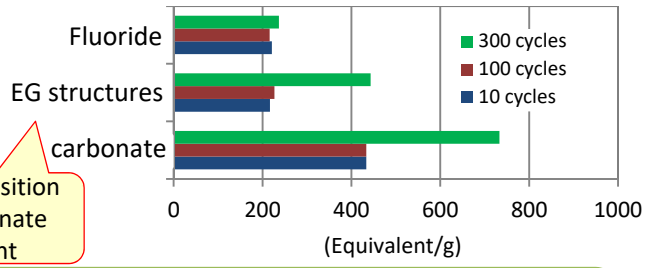
Li quantification shows that Li decrease sat cathode and increases at anode (disassemble at SOC 0%)

→ Irreversible Li in anode is one of the reason for the capacity fade

＜Li quantification by AAS＞

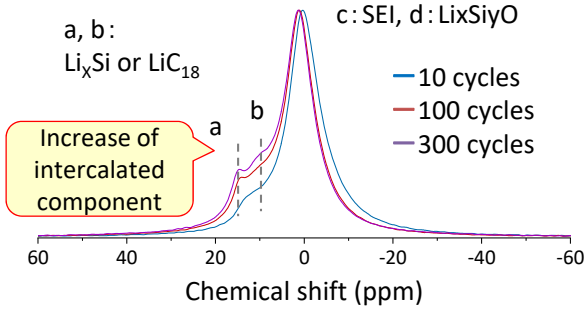


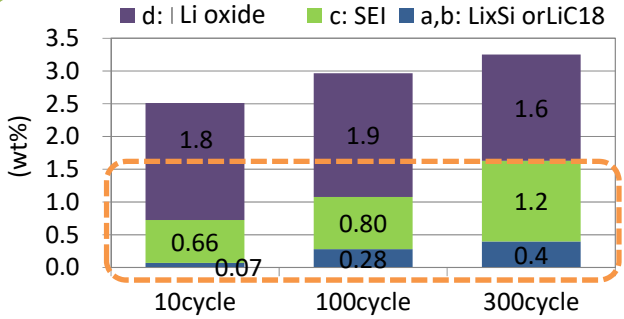
＜SEI quantification by ^{1}H NMR, IC, CZE）＞



Decomposition of carbonate solvent

＜Chemical state of Li ：Solid state ^{7}Li NMR＞





Cause for the increase of irreversible Li

✓ Increase of intercalated Li in anode

✓ Decomposition of carbonate solvent and generation of SEI