Application Note BATT1017

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BATT1017 - XRD Measurement during Charge/Discharge Using All-Solid-State Batteries

Introduction

All-solid-state Na ion batteries are next-generation batteries that are expected to be less expensive than Li ion batteries and have faster charge/discharge performance. When operating all-solid-state batteries, it is necessary to continue applying pressure to make it easier for the ions to move within the solid. With this measurement, using cells that can be charged/discharged while applying pressure to an all-solid-state battery, the behavior of an all-solid-state Na ion battery was verified.

Phase transition analysis

- **Analysis:** Whole battery
- **Analysis method:** Operando measurement
- **Use:** Improving battery performance
- **Analyzed materials:** All-solid-state Na ion batteries (Cathode TiS_2, solid-state electrolyte Na_3PS_4, anodes)
- **Instrument:** SmartLab, all-solid-state battery cells

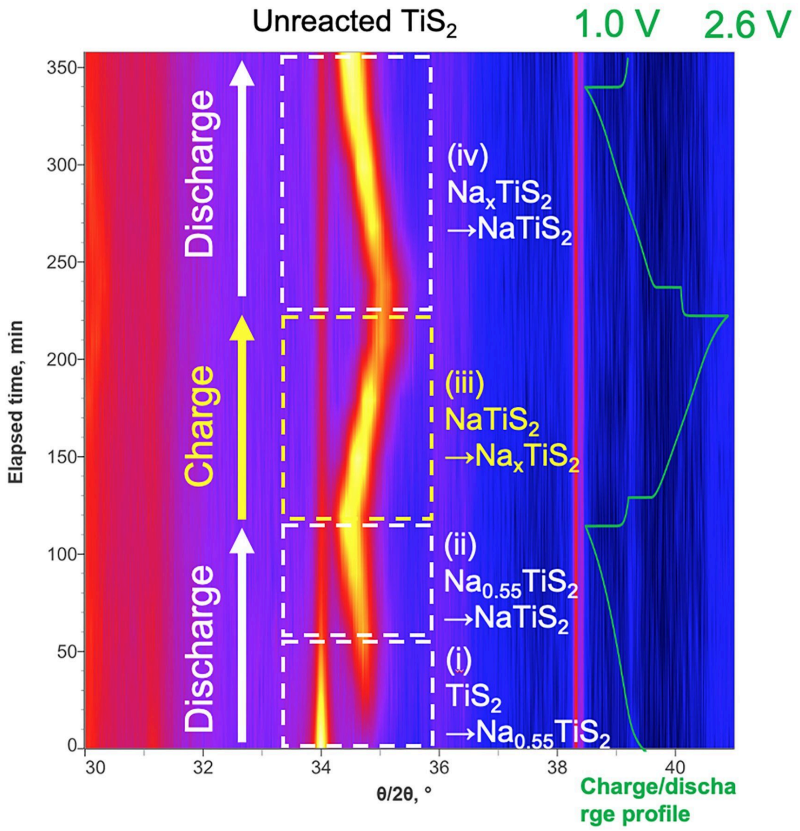

Figure 1: Elapsed time vs 2θ and charge/discharge profile (inside image)

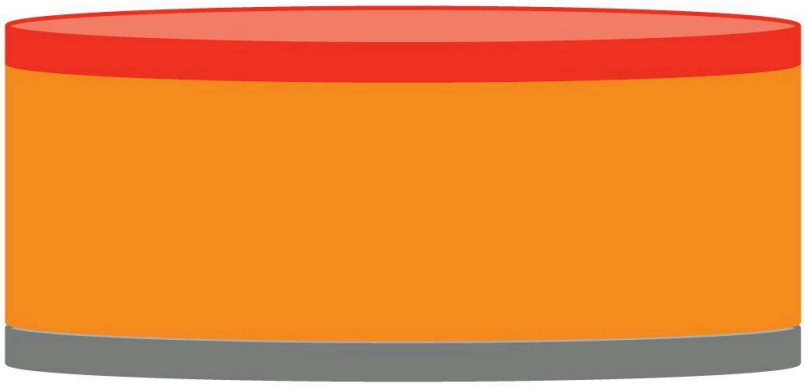

Figure 2: Representation of solid-state battery pellet and pressure conditions

Cathode TiS_2 exhibited the following changes during charging/discharging.

Phase transition from $TiS_2 \rightarrow Na_{0.55}TiS_2$

(i) Change in lattice constant from $Na_{0.55}TiS_2 \rightarrow NaTiS_2$
(ii) Change in lattice constant from $NaTiS_2 \rightarrow Na_xTiS_2$ ($x < 0.55$)
(iii) Change in lattice constant from $Na_xTiS_2 \rightarrow NaTiS_2$

(iv) Unreacted TiS_2 was partially present

Conclusion

It is possible to measure changes in the crystal phase and lattice constant during charging/discharging in an all-solid-state battery.

Related products

SmartLab

Advanced state-of-the-art high-resolution XRD system powe
red by Guidance expert system software