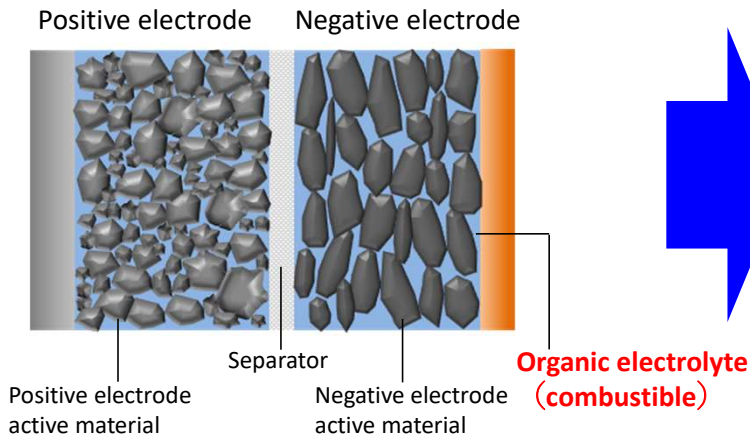


Solid electrolyte

All-Solid-State Battery (ASSB)

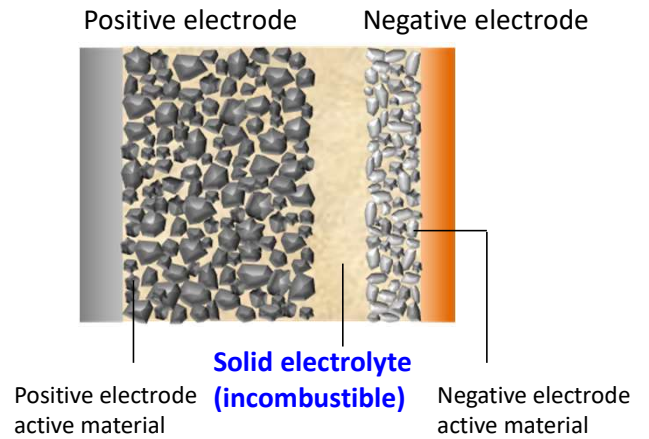
ASSB is expected for high energy density and safety batteries.

Conventional LIB (non-aqueous electrolyte)



- ◆ **Safety**
High risk of explosive combustion at accidents.
e.g. traffic accidents (for mobility use), battery short-circuiting
- ◆ **High energy density**
High-potential or high-capacity electrode active materials are hardly applicable. (Organic electrolyte is decomposed and degraded)
- ◆ **Input/Output characteristics**
Charging rate is limited.
(Organic electrolyte is decomposed due to heat)

ASSB



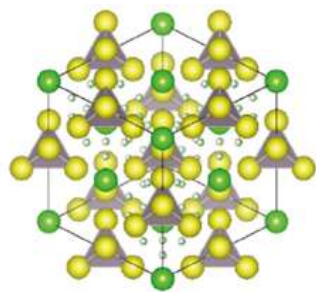
- ◆ **Safety**
High level of safety is achievable.
(Fully composed of incombustible and flame-retardant materials)
- ◆ **High energy density**
Electrochemical stability of solid electrolyte is high, so high-potential cathode materials and high-capacity anode materials can be used.
- ◆ **Input/Output characteristics**
Rapid charging is available.
(Solid electrolyte has thermal stability)

Solid electrolyte

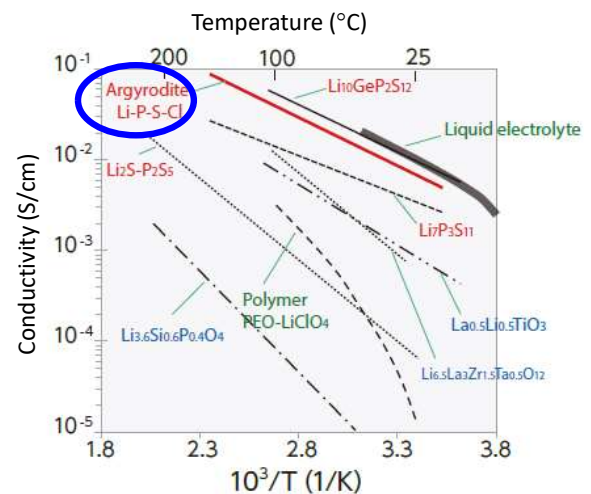
We develop superior argyrodite-type sulfide solid electrolyte which has high ionic conductivity and high electrochemical stability.



Appearance of solid electrolyte developed by Mitsui Kinzoku



Crystal structure of the argyrodite-type sulfide solid electrolyte



Temperature dependence of ionic conductivity of various kinds of electrolytes

Issues to achieve for ASSB

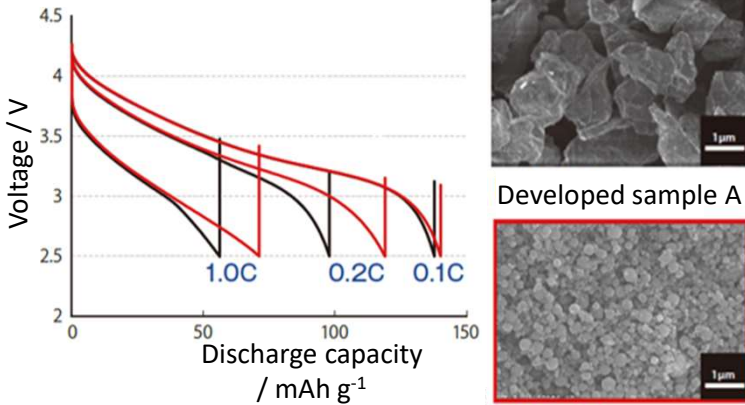
- Improving ionic conductivity of solid electrolyte
- Contacting solid/solid interfaces between active materials and solid electrolyte
- Achieving manufacturing technology for ASSB

Positive and negative electrode active materials

We are focusing on the development for next-generation automotive batteries.

Negative electrode active material

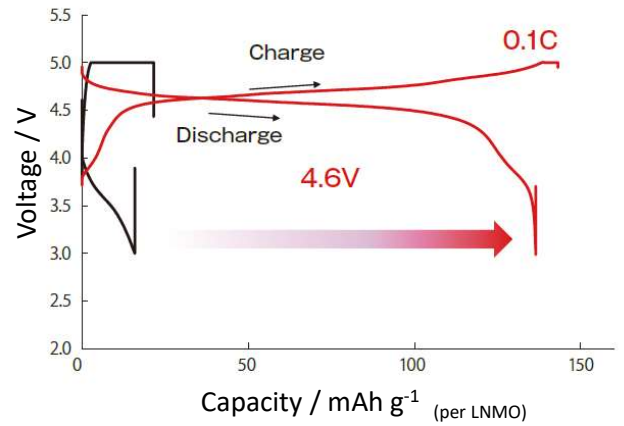
Optimize the material characteristics for all-solid-state batteries.



Discharge profiles of all-solid-state cells using the developed silicon anode materials.

Positive electrode active material

5V high-voltage cathode material (LMNO) works in all-solid-state batteries due to surface-modification.



Charge and discharge curves of 5 V high-voltage cathode material (LNMO) for all-solid-state cells.