Tokyo Tech
Research Units

All-Solid-State Battery Unit

Overview

Smart phones, tablets and other mobile devices have become essential to our daily lives, and the paradigm shift to electric vehicles is expanding globally. The traditional power source employed in these devices has been the lithium-ion battery, which contains a liquid electrolyte. However, safer, more compact, and higher-performing batteries are greatly sought after. The superionic conductor (solid electrolyte) developed by Professor Ryoji Kanno functions over a broad range of temperatures, and its material allows ions to move within the structure selectively at high speed. It delivers outstanding safety and stability, does not leak, and has a high energy density, making it a key technology for all-solid-state batteries. The All-Solid-State Battery Unit leverages its lead in the development of superionic conductors to promote the commercialization of all-solid-state batteries.

Research goals

Development of solid electrolyte materials as a key technology for all-solid-state batteries

(1) Development of methods for synthesizing superionic conductors in large amounts for commercialization
(2) Development of fundamental process technology for commercialization of composite electrode materials
(3) All-solid-state battery prototyping and practical use evaluations (environmental impact assessments)
(4) Demonstration of high performance and functionality through verification of principles and advanced analyses

Research Unit Leader **Ryoji Kanno**

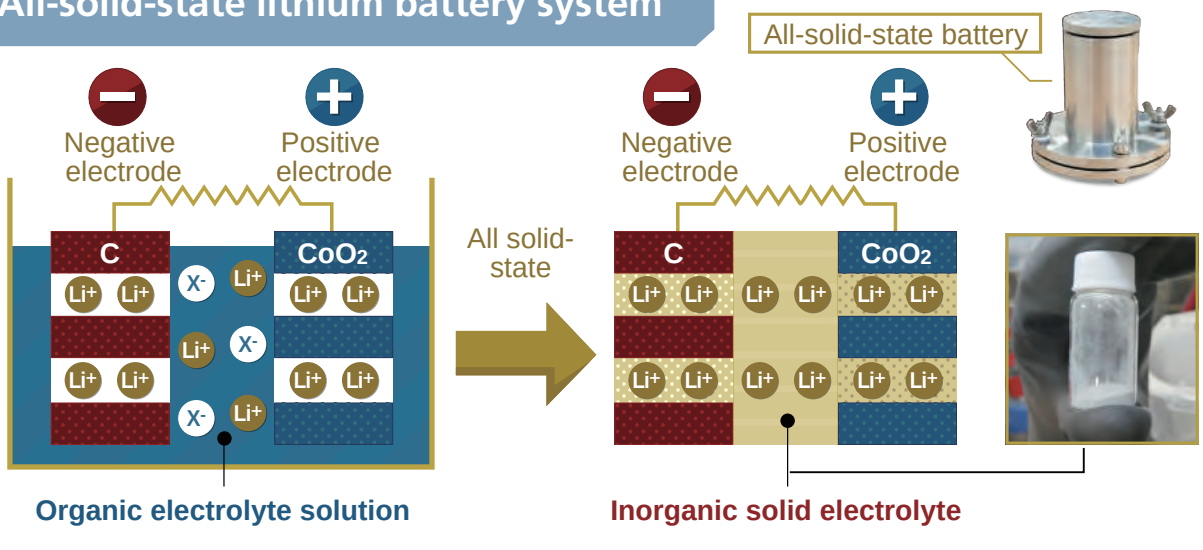
Profile

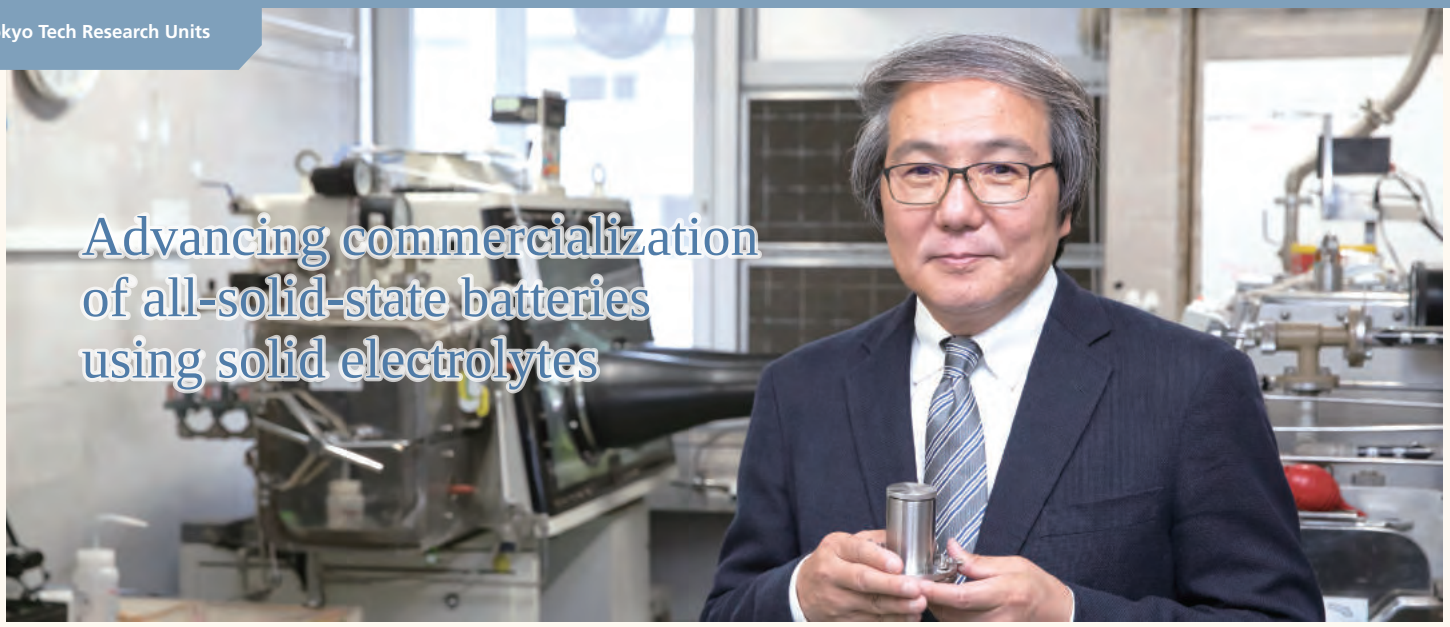
2018 Unit leader, All-Solid-State Battery Unit and Professor, Institute of Innovative Research, Tokyo Institute of Technology
2016 Professor, School of Materials and Chemical Technology, Tokyo Institute of Technology
2001 Professor, Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology
1989 Associate Professor, Faculty of Science, Kobe University
1985 Doctor of Science, Osaka University
1980 Research Associate, Faculty of Engineering, Mie University
1980 Master of Science, Inorganic & Physical Chemistry Division, Graduate School of Science, Osaka University
1978 Bachelor of Science, Department of Chemistry, School of Science, Osaka University

Unit members

- Associate Professor Masaaki Hirayama
- Assistant Professor Kota Suzuki
- Professor Hitoshi Kawaji
- Specially Appointed Professor (IP Strategy) Hidemi Takahashi
- Professor Hajime Arai
- Associate Professor Fusao Kitamura
- Assistant Professor Takeyoshi Okajima

All-solid-state lithium battery system





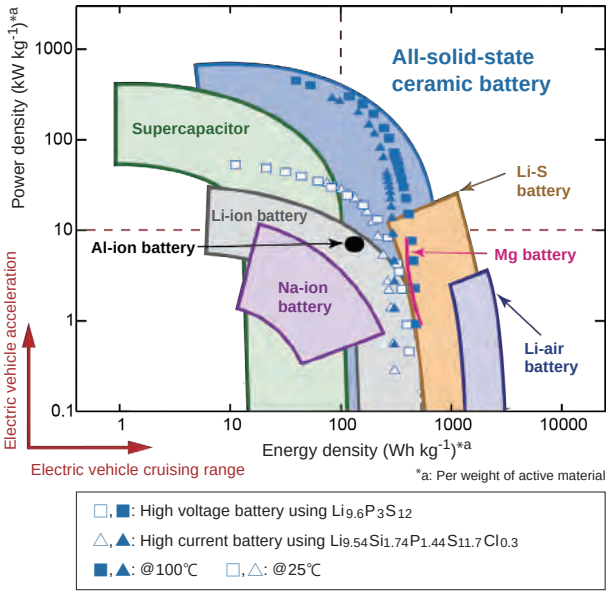
Advancing commercialization of all-solid-state batteries using solid electrolytes

Q Why was this research unit established?

We established this research unit to focus university resources on advancing research, development, and commercialization of all-solid-state batteries. This research unit facilitates collaborations with academia, industry, and government; supports adoption of all-solid-state batteries for mobile devices, electric vehicles, and a wide range of other products; and seeks to open new fields and industries that will apply all-solid-state batteries.

Advances in science are leading to batteries with unprecedented capabilities

All-solid-state batteries from novel materials offer improvements over conventional energy devices.



Q What are the strengths of this research unit?

In 2011, we discovered the material LGPS, a solid electrolyte with high ionic conductivity; and in 2016, we discovered further derivatives of the solid electrolyte. In 2017, we developed a low-cost, all-purpose solid electrolyte by combining tin and silicon. The research has resulted in several key patents.

Q What is the path to achieving the unit's goals?

While we continue development of solid electrolytes providing greater ionic conductivity and stability, we are also working to improve output and lifetime through atomic-level analyses of electrochemical surfaces, the findings of which will feed back to materials analysis. To evaluate the materials, we explore a wide range of parameters utilizing not only regular firing methods, but also high-pressure and thin-film synthesis, as well as materials informatics. Furthermore, we are working to establish a research strategy that ensures cooperation with industry to advance commercialization and creation of new systems to form consortiums. We also participate in national projects involving energy strategy, promote research and development of methods for synthesizing superionic conductors in large quantities for commercialization, and carry out academic-industry-government collaborations for the advancement and application of all-solid-state batteries.

Contact us

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All-Solid-State Battery Unit

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