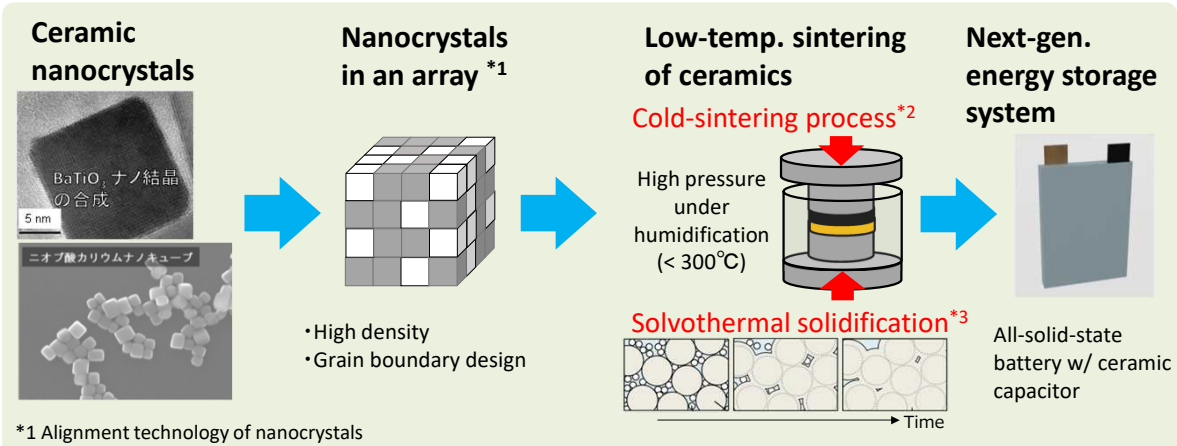
Project Title: Development of Energy Storage Devices Through an Innovative Process of Low-Temperature Sintering of Ceramic Nanocrystals (2021–2024)

Entrusted Parties: National Institute of Advanced Industrial Science and Technology/ University of Yamanashi

Outline of the project

As the performance of IoT devices improves, the demand for ceramic energy storage devices such as all-solid-state batteries and high-capacitance capacitors is expanding. The market size is increasing year by year, and regarding the storage battery market, its size is expected to reach 300 billion yen by around 2030 and over 2 trillion yen by 2050.

The objective of this project is to develop a next-generation energy storage system consisting of a high-performance oxide-type all-solid-state battery and a high-capacitance ceramic capacitor by combining the development of high-density arrangement technology for functional ceramic nanocrystals*1 with innovative low-temperature sintering technology.



*1 Alignment technology of nanocrystals
*2 Sintering technology of ceramics at low temperature (< 300 ºC) using a small amount of water and high pressure
*3 Densification technology of functional ceramics using volume expansion by solvothermal reaction (solid-state synthesis)

Significance of international R&D

By conducting joint research with Pennsylvania State University, the developer of the cold sintering process, which is one of the innovative low-temperature sintering techniques for ceramics, we will accelerate the development of practical advanced energy storage systems.

Project scheme

NEDO
(New Energy and Industrial Technology Development Organization)

Funding

AIST
(National Institute of Advanced Industrial Science and Technology)

University of Yamanashi

Joint R&D contract

Pennsylvania State University
US

Expected outcomes

The innovative low-temperature sintering process developed under this joint research is expected to provide oxide-based all-solid-state batteries using organic materials such as carbon, which cannot be fabricated by conventional manufacturing methods, and high-performance ceramic capacitors. Moreover, a drastic decrease in the sintering temperature of ceramic devices from >1,000 ºC to <300 ºC will lead to reducing CO_2 emissions by about 40% in the entire manufacturing process of ceramic products. The CO_2 emission reduction is estimated to be approximately 1.85 million tons of CO_2 per year in FY2030, when this technology is applied to the manufacturing of ceramic electronic devices as soon as possible.