

# 【Grant-in-Aid for Specially Promoted Research】

## Science and Engineering (Engineering)



### Title of Project : Development of advanced energy storage system based on overall strategies on new materials and new interface

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Research Project Number : 15H05701 Researcher Number : 30359690

Research Area : Engineering

Keyword : Secondary Battery

#### 【Purpose and Background of the Research】

Importance of chemical energy storage technology is well recognized toward future "green" society. Many researches are now independently in progress by just deeply focusing on one element, either already known electrode (cathode or anode) material or already known electrolyte materials. Their combination and a resultant interface (interphase) are optimized based on repeated try&errors and/or empirical guiding principles. Then, the present technology is suffered from limited number of practical materials; only a few electrode materials can be applied to the practical batteries. This situation has forced to apply only one-kind of ethylene carbonate-based electrolyte for more than 20 years. Therefore, a variety of the materials selection is very much limited and it is this situation that has delayed the technical progress in this field.

In this project, we will dramatically increase the variety of guest-ions, host frameworks, and electrolytes as well as their interfacial properties with firm progresses as a battery system.

#### 【Research Methods】

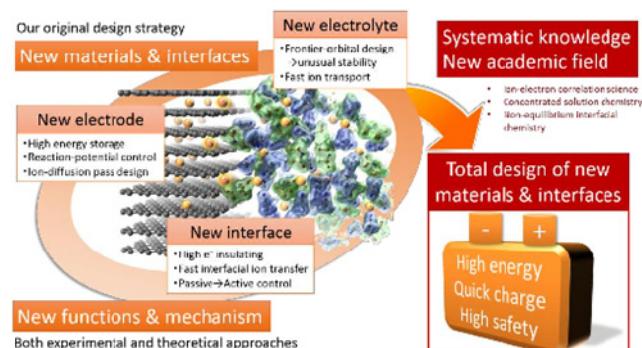


Fig. 1 Overall strategy

Based on our original strategies, we will develop and optimize new cathode materials, new anode materials, and new electrolyte materials. However, exploration and optimization will not be

limited to materials issues but extended to overall battery system, where we will try to set even interface (interphase) issues under control with full understanding of the formation mechanisms using the most advanced ab initio molecular dynamics method as well as spectroscopy equipped in SPRING-8 beam line.

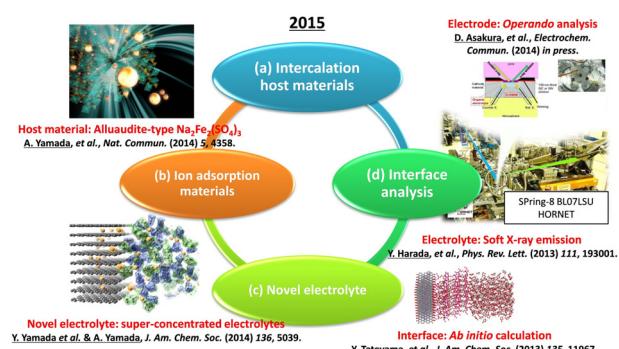


Fig. 2 Methodologies

#### 【Expected Research Achievements and Scientific Significance】

Overall strategies will be established based on the total design of new materials and new interfaces, which we believe to realize new battery system with much more superior properties through sophisticated scientific body of knowledge.

#### 【Publications Relevant to the Project】

- Nature Comm., 5, 4358 (2014)
- Nature Comm., 6, 6544 (2015)
- J. Am. Chem. Soc., 136, 5039 (2014)
- Adv. Energy Mater., 2, 841 (2012)

#### 【Term of Project】 FY2015-2019

#### 【Budget Allocation】 437,100 Thousand Yen

#### 【Homepage Address and Other Contact Information】

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