

## Science and Engineering



### Title of Project : Aquatic Functional Materials: Creation of New Materials Science for Environment-Friendly and Active Functions

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#### 【Purpose of the Research Project】

In this project, Aquatic Functional Materials is defined as materials that harmonize and interact with environment and bio-systems in the existence of water. The objective of this project is to create and establish materials science on Aquatic Functional Materials and to develop innovative materials by fusion of materials science and basic science of water. Water is essential for the sustainable development of human civilization as described in the SDG6 of the United Nations. It is our emergent issues to develop Aquatic Functional Materials serving in a wide range of the fields including environment, energy, healthcare and agriculture.

#### 【Content of the Research Project】

The specific feature of our project is to understand the interactions between water and materials in the level of molecules and molecular nano-assemblies based on fundamental science of structure-function relationship between water and materials for the creative development of Aquatic Functional Materials. We study on Aquatic Functional Materials from a wide range of standpoint of views including organic chemistry, polymer chemistry, experimental physics, computational science, and engineering.

As bio-system and global environment do not function without water, we focus on behavior of water as molecules for materials science. In this project, we define aquatic environments as living and industrial regions where water exists, and bio-system as well as hydrosphere because there are common features that interactions of water molecules with molecules and materials play key roles.

New principles of materials design are required to develop materials that exhibit high function in aquatic environments. We need to establish unified materials science based on understanding of structure-function relationship between water and substance. In conventional water science, structures and properties of water as single



Figure 1. Fusion of sciences and engineering for the achievement of research in this project.

components have been mainly studied. In conventional materials science, for example, electronic materials and polymer materials to be used in non-aquatic circumstances have been intensively focused. It is our intention that we unify science of water and materials science together and further develop to establish science of Aquatic Functional Materials.

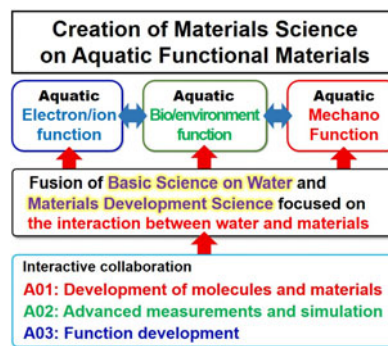


Figure 2. Scheme of research in this project.

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

1. Creative development of innovative materials that function in aquatic environments

The development of highly functional materials in the coexistence with water, which were not well studied, is expected. For example, we expect the fabrication of aquatic electron/ion functional materials

2. Creation of Science of Aquatic Functional Materials  
New science that gives design principles for materials that exhibit high functions in aquatic environments will be established by fusion of basic science of water and materials science.

#### 【Key Words】

Aquatic Functional Materials: In this project, materials that function in the living and industrial regions where water co-exists, and bio-system as well as hydro-regions of ocean and river of sphere are defined as Aquatic Functional Materials. It is because that when we examine behavior of water and interactions of water in molecular level, there are common issues in science.

【Term of Project】 FY2019-2023

【Budget Allocation】 1,185,200 Thousand Yen

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

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