Research area in Strategic Objective *"Materials Science for desirable Selection — Constructing new principles toward a sustainable development society"*

Basic Research for the Development and Recycling of Materials

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Overview

This research area aims to establish basic science for developing and recycling materials and fundamental technologies to address the environmental and resource problems faced around the world. In order to respond to the demands of society, such as the depletion of resources, reduction of environmental impact, and increase in the use of recycled materials, it is important to create materials from raw materials that are not subject to such restrictions and to create fundamental technologies for the separation, recovery, and recycling of used materials as desired. It is also important that these technologies are interconnected and function as a recycling cycle.

We aim to contribute to realizing a resource-recycling society by constructing a new basic science for material creation and recycling based on various academic findings beyond the framework of conventional material science and by working on developing fundamental technologies for these processes.

Research Supervisor's Policy on Call for Application, Selection, and Management of the Research Area

1. Background

Our lives have become comfortable and functional, supported by the mass production and mass consumption of functional materials and materials. At the same time, environmental problems such as the release of greenhouse gases represented by CO2, environmental runoff of hazardous substances, and plastics in the oceans have become apparent, and there is a growing movement to increase the use of recycled materials and to restrict the use of hazardous materials. In Japan, the lack of resource reserves and concerns about securing resources due to geopolitical risks are also major issues. Under these circumstances, there is an urgent need to create alternative materials to those that are subject to

various regulations and to develop fundamental technologies for creating materials with recyclability in mind, utilizing resources that are abundant and relatively easy to obtain in Japan, as well as resources recycled from materials that are currently incinerated or disposed of in landfills. In addition, to utilize recycled materials as resources, it is also important to establish fundamental technologies related to recycling, such as separation, decomposition, and recovery, which enable the provision of used materials in an optimal form for material creation.

In this research area, we will incorporate issues extracted from these social problems into basic research and aim to establish basic science for developing and recycling materials and fundamental technologies.

2. Recruitment and Selection Policy

(1) Fundamental Policy

In this research area, we identify issues based on social demands regarding environmental and resource constraints and promote basic research to solve these issues.

Our research interests include metallic, inorganic, organic, and metal complexes, polymeric materials and their composites, and products made from these materials. Research areas include materials chemistry, physics, environment and energy, biotechnology, mechanical engineering, electronics, nuclear energy, geology, oceanography, and many other fields that deal with materials. Proposals should not be mere extensions or refinements of research addressed in existing similar programs but should be novel in concept and challenge new academic fields. In particular, we strongly encourage proposals that are feasible as individual-type research and lead to establishing basic scientific principles.

(2) Expected Research Contents

A. Research and development of materials

a. Developing functional, high-performance materials that overcome environmental and resource constraints.

Research is aimed at developing new materials using general-purpose elements and ubiquitous materials with properties that are equivalent or superior to those of materials that have properties due to their complex composition or structure, or due to the use of rare elements (e.g., laminated films, lithium batteries, structural materials, various composite materials, etc.), or materials that have been identified as having safety issues or environmental impacts (e.g., fluoropolymers, lead products, general purpose plastics, etc.), and that are recyclable or biodegradable to the extent possible.

b. Developing materials with low environmental impact and recyclable properties from recycled materials.

Research seeks to understand the characteristics of recycled materials, many of which have different

properties than high-purity materials, such as impurities and mixtures, and to develop novel materials that take advantage of these properties as well as low environmental impact and recyclability.

c. Development of new materials from recycled materials and products.

Research objectives are to develop new materials from waste materials or products without or with minimized separation, disassembly and recovery processes.

B. Research on separation, decomposition, and recovery methods

Academic research and development of basic technology to design recycled material supply methods optimized for the high functionality and multifunctionality they aim for, to construct economically efficient and high-speed processes (including material recycling and chemical recycling), and to elucidate their mechanisms with a strong focus on supplying materials for the creation of materials.

3. Research periods and research funds

The total research budget is limited to a maximum of 40 million yen (direct costs) per proposal. The research period is 3.5 years or less.

4. Principle of research-area management

In carrying out the research described in (2).2 above, new knowledge and techniques may be required. To promote research efficiently, we encourage collaboration with related laboratories in Japan and overseas, as well as joint research with overseas laboratories. In particular, with regard to collaboration between material creation research and separation, decomposition, and recovery method research, we aim to contribute to the realization of a resource-recycling society by promoting the integration of each through active interaction between research supervisors/area advisors and researchers, as well as among researchers in the research area.

In addition, we will promote active exchanges and collaboration among researchers in this research area through meetings scheduled twice a year to create new academic principles from the fusion of different fields and promote networking among researchers who have not had contact with each other before.

We will also promote collaboration with CREST "Materials development and recycling," which is implemented under the same strategic goal, and academic exchanges with external parties in the field.

Through the above activities, we will not only produce research results, but also make opportunities to nurture the leadership of selected researchers so that they will become future leaders of science.