●Development Stage

(Fiscal Year 2008–2010)

Mie/Ise Bay Shore Area

Development of a Next-Generation All-Solid Polymer Lithium Secondary Battery and its application in the development of advanced materials

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Life Sciences
IT
Environment
Nanotech Materials
Others

Framework for Project Promotion

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Core Research Organization

- Mie University

Major Participating Research Organizations

- Industry…Kinsei Matec Co., Ltd., Kureha Elastmer Co., Ltd., Shin-Kobe Electric Machinery Co., Ltd., Toppan Printing Co., Ltd., Meisei Chemical Works, Ltd.
- Academia…Mie University, Suzuka National College of Technology
- Government…Mie Prefecture Industrial Research Institute

Aims of Project

The Advanced Materials Cluster Project of Mie Prefecture promotes the development of world-class industry in the fields of complex compounds and materials. Research and development in the present project will focus on a safe, light-weight, and flexible all-solid-state polymer lithium secondary battery that operates at low temperatures. Emphasis is placed on the promotion and creation of manufacturing industries concerned with advanced materials and batteries, and the battery-assembling industry via cooperative companies and approved companies.

During the Basic Stage of the City Area Program, we achieved a world-first by developing a thin and flexible all-solid-state polymer lithium secondary battery that works at room temperature. This battery has the characteristics of low cost, high safety, and operation at low temperatures, resulting from improvements to the employed polymer electrolyte, anode material, and cathode material, and the application of a control method for the layer interfaces and a roll-to-roll printing method, etc.

Contents of Project

1. Development of the component materials for batteries

Lithium ion secondary batteries, as widely used in laptop computers and cellular phones, have problems in terms of safety and durability, including the risk of fire arising from the use of organic solvent electrolytes.

In this project, we will develop three main component materials (solid polymer electrolyte, anode material, and cathode material) for use in all-solid-state polymer lithium secondary batteries with enhanced safety arising from the removal of organic solvent electrolyte.

We developed for practical use a polyethylene-oxide-system polymer electrolyte with high ionic conductivity over a wide temperature range, high strength, and high elasticity.

We developed highly conductive and reversible anode material of $LiFePO_4$ and cathode material of graphite or Si, with the aim of controlling the interface for fitting to a polymer electrolyte and operation over a wide temperature range.

2. Battery composition, manufacture, and evaluation

We developed the design technology for the optimum layer structure (cathodic layer/polymer electrolyte layer/anodic layer) with the aim of the practical use of an all-solid-state polymer lithium secondary battery. This was achieved by focusing on interface control technology and lowering the interfacial resistivity.

We will also manufacture and evaluate a battery using sample material developed as part of Theme 1; the evaluation results will then be fed back to Theme 1.

To reduce the battery production costs, we will investigate the application of a roll-to-roll printing process in battery manufacture.

We will also investigate the evaluation method required for the likely conditions of practical use of the polymer battery.

Polymer Lithium Battery Sheet

3. Market evaluation for the proposed battery

We will verify the effectiveness of the potency of all-solid-state polymer lithium secondary battery with superior safety, long cycle life, long reservation life, thin shape, flexibility, and low cost of production. In order to select a field of application for the battery in established and new markets, with a view to starting an enterprise, we will collect and analyze market data from battery manufacturers and users. Research and development will then take into account not only the battery materials and processing, but also market factors, concurrent with promotion in three steps from Themes 1 to 3: from the development of materials to market development and finally trial manufacture.