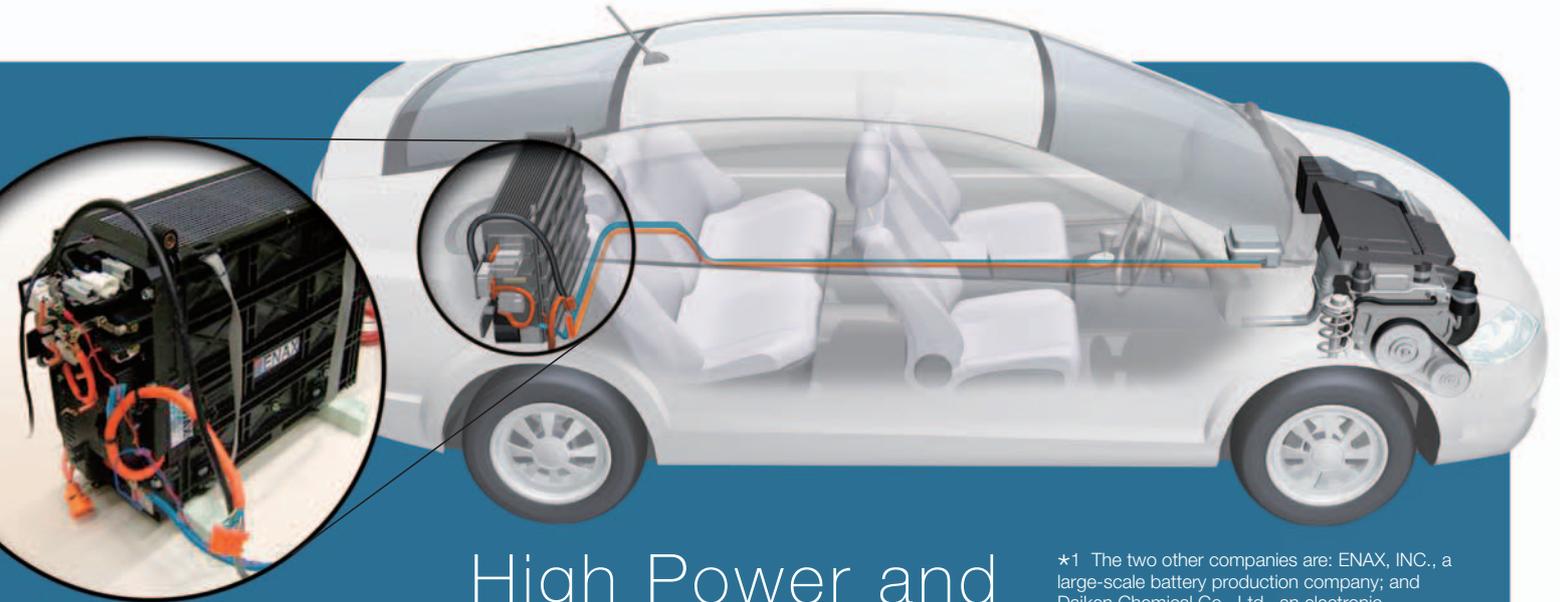


## Feature② Murata's New Businesses

# A Step Taken for the Future

Murata is exploring the possibilities of new technologies to cultivate the new businesses that will contribute to the society of the future. The themes the Company is pursuing are the environment, energy and biotechnologies. The challenges we face are controlling emissions of greenhouse gases that lead to global warming and early detection of adult diseases.



## High Power and Safety for Hybrid Vehicles

### Development of High-Power Lithium Ion Secondary Batteries Using Murata Specialist Monolithic Technologies

Hybrid vehicles run on gasoline engines and electric motors. Key to their widespread use is increased functionality of the secondary batteries (rechargeable batteries) that serve as a power source for their motors.

Nickel-Metal Hydride batteries are used in currently marketed hybrid vehicles. These batteries, put to practical use in 1990, provide twice the electrical power capacity of previously mainstream nickel cadmium secondary batteries, in addition to being free from noxious cadmium and offering other superior characteristics.

Murata is promoting high-power lithium ion secondary batteries for hybrid vehicles. Double the power of Nickel-Metal Hydride batteries provides superior acceleration, in addition to shorter recharge time, longer life and compact design. To realize these ideal power sources, we tied up with a large-scale battery production company and an electronic component materials manufacturer\*1. Murata, a leading

company of chip monolithic capacitors, merges its unique layering techniques, electrical double-layer capacitors\*2 once commercialized and battery material technologies, with the two companies' battery and materials technologies, and aims to bring high-power lithium ion secondary batteries to the market by fall 2008.

The car is intended to transport passengers. Therefore, ensuring of safety is of paramount importance. However, lithium ion secondary batteries use organic solvents, which has led to criticisms of uncertain safety at high temperatures. In response, Murata has employed a monolithic structure with excellent radiation performance. Furthermore, through the use of special materials, we have bolstered safety performance, with experimental results showing no ignition, even at several times overcharge of specified values. Murata is building safe and powerful ideal power sources to spread hybrid vehicles with low environmental load.

\*1 The two other companies are: ENAX, INC., a large-scale battery production company; and Daiken Chemical Co., Ltd., an electronic component materials manufacturer.

\*2 Electrical double-layer capacitor: A type of capacitor, which serves as a device that can temporarily store and discharge electrical energy. Compared with conventional batteries, these capacitors last longer and recharge more quickly.



### Ensuring Safety at Full Power in Hybrid Vehicles

#### Masanori Endo

Manager, Engineering section, Energy Device Business Development Department

We began partial sample shipments of Murata's high-power lithium ion secondary batteries in spring 2007. They are characterized by instantaneous high output and enhanced safety.

We are working on improving electrical characteristics and ensuring absolute safety with a view to supplying these batteries for hybrid vehicles. Currently, we are going through repetitions of trials and assessments.

# Contributing to the Field of Healthcare

## Development of Biosensor Using Microwave Components

Murata wants to contribute to healthcare by applying its accumulated technologies in the field of microwave components. This is the background why Murata started the biosensor development.

Those biosensors are used to detect proteins, DNA and other biomaterials in whole blood. Applications are anticipated in the clinical diagnostics for the purpose of discovering the hidden causes of diseases and quantifying the state of a patient's health.

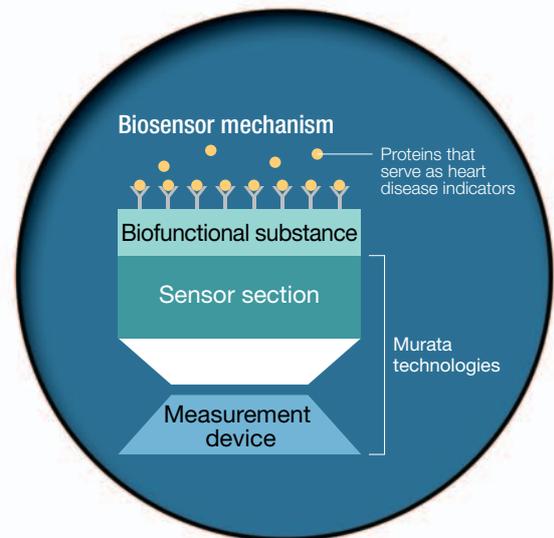
Murata has been carrying out this development jointly with a Danish venture enterprise.

Those biosensors that measure protein traces in blood apply the same technologies for the microwave components that suppress noise in mobile telephones. Of course, in the development of biosensors, the application and environment for microwave components differ from the mobile telephone applications. Murata is promoting research to find out and secure the best way to realize accurate,

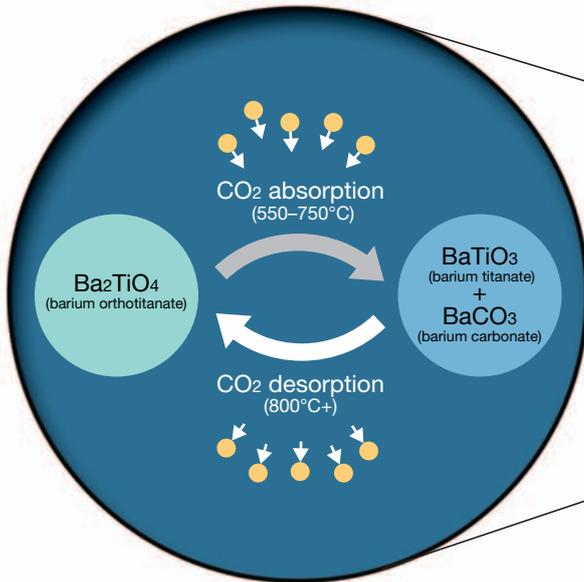
stable measurement with these new parameters.

The conventional detection equipment of this kind are very expensive and bulky, and, therefore, those are not well accepted, at this moment, in small-scale clinics and hospitals. However, developing compact and high-precision biosensors are believed to contribute much to more introduction even to small clinics, and also facilitate swift and accurate diagnosis results even by minute blood samples.

By promoting R&D of such biosensors, Murata believes that it will make major contributions to the field of medical diagnostics by providing solutions for the early detection of causes of cardiac diseases.



## A Step Taken for the Future



CO<sub>2</sub> absorbent material (barium orthotitanate)

# CO<sub>2</sub>-Capturing Ceramics

## Development of Ceramics that Absorb Carbon Dioxide

### New Materials with a Potential Role in Global Warming Prevention

Conventional CO<sub>2</sub> reduction strategies have focused on emissions control through energy reduction. However, in recent years CO<sub>2</sub> absorbent materials that recover gases after emission have also attracted attention. Murata is also currently involved in the development of such promising CO<sub>2</sub> reduction technologies, focusing on highly functional materials that can absorb approximately 100 times their own volume of carbon dioxide.

Murata has been researching effective uses for the ceramic waste materials generated by its existing capacitor production processes. In 2005, we invented efficient CO<sub>2</sub> absorption and desorption functions at high temperatures in barium orthotitanate (Ba<sub>2</sub>TiO<sub>4</sub>) synthesized using barium titanate, which is a raw material for one of the Company's major products, ceramic capacitors. Since 2006, we have been developing experimental prototypes in collaboration with a CO<sub>2</sub> recovery equipment manufacturer and are currently conducting evaluation tests.

Barium orthotitanate is

characterized by stable performance at high temperatures and durability against sustained usage. It can be used at temperatures exceeding 900°C, well outside the ranges allowed by conventional absorbent materials (100–200°C), which eliminates the need for cooling CO<sub>2</sub> prior to recovery. Accordingly, this substance has potential applications with such high-volume, high-temperature CO<sub>2</sub> producers as power generation plants and iron and steel works.

If applied to removing high-temperature CO<sub>2</sub> generated in the hydrogen gas fuel production process for fuel cells, it will facilitate generation of 98% concentration hydrogen.

Furthermore, as the CO<sub>2</sub> is recovered at a high temperature, it can easily be used as a material to synthesize other useful substances.

Barium orthotitanate, as a CO<sub>2</sub>-capturing ceramic, assists the recycling of waste materials from the capacitor production process, helping to prevent global warming. In addition, it can supply other production processes with CO<sub>2</sub>, rendering it a multipurpose, highly functional material.

### Potential Applications in Hydrogen Filling Stations

#### Yoshinori Sato

Materials Development Management Division, R&D Center

Fuel cells that can act as power sources without generating CO<sub>2</sub> are anticipated for next-generation automotive applications, although CO<sub>2</sub> is emitted as a byproduct when generating the hydrogen these cells uses as fuel.

Accordingly, applying barium orthotitanate to CO<sub>2</sub> absorption equipment at hydrogen filling stations could resolve this issue. This in turn could be a step toward the construction of the hydrogen society that is envisioned for the future.



# MURATA BOY Natural Science Classes and Environmental Learning

**For the Children of Today, Who Will Inherit the Earth of Tomorrow**

## Implementation of Environmental Learning to Communicate the Importance of Environmental Conservation

In addition to conducting its own environmental preservation measures, Murata believes that it has a corporate responsibility to communicate the importance of global environmental protection to society as a whole.

Since fiscal 2005, we have conducted programs at elementary and junior high schools in the neighborhoods of our factories and hosted presentations and other events for children to actively promote environmental education.

Environmental representatives from the Company's staff introduce current issues and Murata's activities on the themes of the 3Rs (Reduce, Reuse and Recycle) and global warming.

These highly popular events are delivered in the form of a quiz, to encourage children to enjoy themselves while deepening understanding of the importance of a recycling-based society and global warming prevention. In fiscal 2006, the second year of this program, we expanded the agenda four-fold in terms of numbers of events and participants.

## Natural Science Classes Held by Murata-Developed Robots

During fiscal 2006, we commenced natural science lessons with the objective of communicating the fun side of science to children.

These events feature the MURATA BOY robot, whose popularity with kids is spurred by appearances in television commercials. Children experience MURATA BOY close up, as he furiously peddles a bicycle, while exploring the mysteries and surprises of natural science. At the same time, the various uses in society of Murata's leading-edge technologies, such as the



"Children's Science" provides easily understandable explanations of MURATA BOY's advanced technologies in a series of books for children.

sensors and communications modules mounted in MURATA BOY, are introduced in an easily palatable fashion.

In the six months following their instigation in October 2006, such natural science classes were held 11 times in the neighborhoods of Murata's factories and subsidiaries. MURATA BOY has also been recruited to collaborate in environmental lessons. In the future, we plan to expand our range of electronics educational materials and programs.

Against the background of claims that today's youngsters are drifting away from natural sciences, Murata aims to continue to draw the attention of today's children, who carry the Earth's future, back to the environment and to science.

Children enjoy our Environmental Quiz, pitting class groups against each other. After the lessons, we are bombarded with enthusiastic resolutions to "start protecting the planet in any way we can!"



## Hopes for Children to Have Their Own Eco-Life

**Keiko Hosomi**

Environmental Management Section,  
Environmental Management Department

If even one of the children attending Murata's environmental learning programs takes environmental problems on board, he or she has a starting point for environmental conservation activities either at home or at school.

Moreover, this environmental learning provides opportunities for someone like myself, with almost no contact with children, to experience their flexible creativity and limitless energy and to find time, so rarely afforded in daily work, to enjoy being with kids.

