

Starting Stage

(Fiscal Year 2004-2006)

# Ehime Eastern Area

Development and Application of Intelligent Functional Material

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### Project Promotion

Chief Scientist... Junichiro Ninomiya  
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 Science and Technology Coordinator... Keijiro Haritani

### Major Participating Research Organizations

Industry... MIKI TOKUSHU PAPER MFG.CO.,LTD., Unicharm Corporation, MARUSUMI PAPER CO., LTD, KAMI SHOJI CO., LTD, Nissen Chemitec Corporation, KURARAY SAJO CO., LTD, TAKUBO INDUSTRIAL CO., LTD., KansaiKakou Co.,Ltd and other organizations within this area  
 Academia... Niihama National College of Technology, Ehime University  
 Government... Paper Industrial Research Center of Ehime Prefecture, Industrial Research Center of Ehime Prefecture

### Core Research Organizations

Niihama National College of Technology  
 Paper Industrial Research Center of Ehime Prefecture

### Aim of research and development

The east part of Ehime Prefecture area accounts for a large amount of industrial shipment as about 50 percent of Ehime Prefecture, and is the largest industrial area of the Shikoku the greatest that accounts for about 20 percent in the entire Shikoku. This area consists of the Shikoku central city region where is the center of the paper industry, and Niihama City and Saijo City that have other materials and the processing and assembly industries where the major companies such as a metal, a chemistry, general machines, and electric machines have the business base in the area.

This project aims to match the needs of industry where the regional characteristic in diversity and the technical seeds of academia research group and government to promote the research and development activities in the region. Therefore, the project "Development of intelligent functional paper that has advanced sensing function" was launched as the joint program of industry-government-academia research group in cooperation with Paper Industrial Research Center of Ehime Prefecture and Niihama National College of Technology in order to facilitate exchanges and communication between regional entities for promotion of research and development activities in the area.

### Contents of research

#### 1. Feasibility test

In FY2005, there were 10 topics applied and completed (6 for FY2004). While there are some topics under study with companies, the following are those which have high potential for success in the future.

- 1) Development of applied technology of water/ceramic electrode (patent applied)
- 2) Research and development concerning creation of functional nanocomposite pulp
- 3) Development of a new, effective sulfuric acid mortar of flyash with high CaO content of radioactivity

In FY2006, 10 topics have been adapted and studied currently as the needs from companies were increasing.

These topics are expected to have a positive ripple effect on the local industries.

#### 2. A joint research "Development of intelligent functional paper that has advanced sensing function"

In "Development of the intelligent materials", we proposed three sub-topics including development of a functional paper that has the environmental response, the development of the biomimetics paper, and establishment of the basic complexing technology with intelligent materials and paper in 2006.

In "Development of intelligent sensing materials", there are three topics including preparation of the composite membrane comprised of functional dye and polymer, development of synthetic method of optically active biodegradable polymer by microwave, and preparation of environmental clean-up biocatalysts.

### The main study results

1. Development of applied technology of water/ceramic electrode  
 Made Alumina amorphous and bulk-type amorphous ceramics
2. Develop investigation concerning creation of functionality nanocomposite pulp  
 The nanocomposite pulp was supported by Zeolite applied to the pulp fiber in the first stage of process of pulping.
3. A new effective use of flyash with CaO in high content  
 A type of mortar with comparable durability against sulfuric acid was developed, which is superior compared to ordinary mortar or those which mixed with blast furnace slag, while the mechanism of durability against sulfuric acid was clarified.
4. Development of intelligent functional paper that has advanced sensing function  
 In FY2005, the research aiming at the development of specific intelligent functional paper was conducted as below:
  - 1) The complexation by the interfacial polymerization method and the polyion complex method was studied and found to be effective for complexation of functional materials with temperature adjustment functions, those which respond to the inner element of the material and papers
  - 2) In the above-mentioned interfacial polymerization method, it was found that a shape of the film can be controlled through adjustment of the spread factor.
  - 3) The synthesis of an intelligent dye which has superior in sensitivity to ammonia gas and good complexation with paper, preparation of biodegradable microcapsule with polylactic acid, and the preparation of intelligent paper having environmental clean-up enzyme.

