

Fine Chemical Business

Concentrating resources in the information and automotive safety product fields, for rapid development and marketing of new products using a “fusion of research.”



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Improving profit-earning capacity with new products and new business areas

Despite harsh conditions for the Fine Chemicals Group, a bright future began to make itself visible during FY 2003.

In the information field, one of our group's main strengths, a market recovery was finally seen during the last half of the year. However, in the field of automotive safety products, which we expect to develop into our main field in the future, we faced a continued bitter struggle as we were dragged down by strong demand for lower prices from automotive parts manufacturers. For our inflator business, we have at long last completed our tripartite global system. In the future, we will strengthen our sales expansion efforts in the U.S. market, and work to increase our market share in Japan and overseas.

Demand has grown rapidly for the non-halogen grade epoxy resins used for encapsulation of semiconductors, a product for which we hold the top market share in Japan. Our business producing colors for color inkjet printers is also growing steadily. We have made a good start as well with new products related to liquid crystal displays, optics, and data storage. In particular, rapid growth is expected in the future for materials related to DVD disks, as the use of DVD recording devices becomes more common.

Overseas, operations began in the autumn of 2003 in the city of Wuxi, China, at both our plant under construction for production of PCB resist ink materials (Kayaku Chemical Wuxi Co.,Ltd.: KCW), and at the plant of our consolidated subsidiary Polatechno Co.,Ltd. for production of polarizing films (Wuxi Polatechno Optics Co.,Ltd.: WPLC).

In FY 2004 we are planning to accelerate the launch of new products from these plants in Japan and overseas, strengthening our profit system.

Concentrating on the information and automotive safety product fields

In the fine chemicals business, we will continue to concentrate our resources in the automotive safety product field and information field, which we have determined to be growth areas for the future.

The information field is finally back on a path to recovery. We are expecting high growth in the future, corresponding with the expected growth of a range of digital appliances, and particularly due to the planned introduction of digital televisions in 2005. In addition, with the current deflationary economy, our group has enacted plans to improve cost competitiveness in order to secure a superior competitive position. We will continue to persevere with these plans in the future.

We expect that these plans will deliver greater effects in FY 2004.

"Fusion of research" that spans our whole organization

Our group has succeeded in bringing about a fusion of the numerous technologies in its possession. It has divided its R&D efforts into short/mid-range themes and long-range themes, and has established a clear system of responsibility for each, with the former being tied directly to business, and the latter intended to establish a technology base. Centering on our long-range themes, we are also actively pursuing joint research with universities and a variety of other public research institutions.

Using this system, we are making solid progress in development of downstream products – basic materials, composite materials, processed materials, and assembly parts and components, while at the same time maintaining close links with our customers.

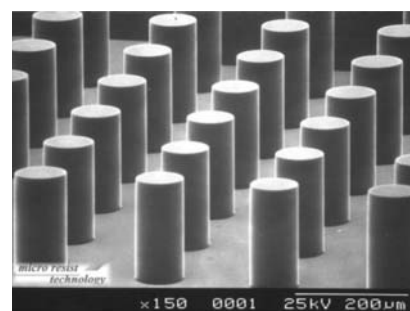
In the future, we will proceed with commercialization of products including next-generation squibs that make use of the applied semiconductor technology that we are developing for practical use, new resins such as polyimide and polyamide resins, and a wide range of functional films.

[Functional Products Business]

Entry into the field of photo resists for micro-machine manufacture

The resin technology we have developed through the production of epoxy resins used for semiconductor encapsulation allows us to consistently maintain our position at the top of the industry. In April 2002, Nippon Kayaku concluded a technical tie-up with the U.S. venture company MicroChem Corp. (MCC, Massachusetts, USA), and entered into the field of photosensitive resins (photo resists used for manufacturing micro-machines) which are used for production of inkjet printer nozzles and other micro-molded parts. In December 2002, MCC, Tomem Corporation, and Nippon Kayaku founded Kayaku MicroChem Corporation (Tokyo, Japan), a joint venture company, and began import and sale of MCC products. The purpose of this collaboration is to pioneer new demand among Japanese and Asian electronics manufacturers and jointly develop sophisticated new products by applying MCC's specialized technology for photosensitive resins and Nippon Kayaku's technology for high-purity special epoxies.

In particular, the SU-8 series of chemically amplified thick UV negative resist is ideally suited for fine three-dimensional processing. The SU-8 series is used for miniaturized products such as printer ink nozzles, micro-machine motor parts, magnetic head dies, and biochips. Its properties are different from the photosensitive resins used for semiconductors and circuit patterns, and is most noted for its ability to form three-dimensional shapes on a scale of several tens to hundreds of micrometers. Focusing on the new micro-machine technology market, Nippon Kayaku will develop and market resist products unlike any before.



SU-8 series ideally suited for fine three-dimensional processing

Increased production of pigment dispersion photoresists

Cell phones and digital cameras contain light-sensitive elements (such as a charge-coupled devices, or CCDs) mounted on a silicon PCB, and a color filter formed on each element. In the spring of 2003, Nippon Kayaku strengthened its facilities for manufacturing pigment dispersion photoresists for color filters, aimed at meeting demand in the digital camera, camera-equipped cell phone, and related markets, all of which have shown remarkable growth in recent years.

These resists, which utilize acrylic resins, are used on color filters in the patterning process for the red-green-blue (RGB) primary colors. Our resists feature superior spectral characteristics and high resolution, which have led to increasing demand for them as mass production of CCDs expands. In the future, we will continue to develop and market photoresists for the next generation of CCDs.

Entry into the UV-curing sealant market

The market for UV-curing sealant which can be used with increasingly larger LCD displays has much potential for development in the mid- and long-range, with more demand expected as companies change to UV-curing type from heat-curing type. We successfully entered the UV-curing sealant market in February 2003, when we installed new equipment at the Asa Plant (Asa-gun, Yamaguchi Prefecture) for production of sealant for LCDs based on acrylate resin and cured by UV radiation.

This sealant is used in the production stage to fill the gap between the liquid crystal and substrate layer. Compared with existing epoxy-based sealants that are cured by heat, this resin is cured when exposed to UV radiation, and can greatly shorten the LCD production process. UV-curing sealants which can be used with the larger 50-inch and 60-inch LCD displays can help streamline production lines, and we have fielded numerous inquiries from manufacturers who plan to introduce this newer resin in the future.

Expanded post-processing of polarizing films in China (Polatechno Co., Ltd.)

Polatechno will expand its annual production capacity for post-processing of polarizing films in China to 300,000 units by 2004. Polatechno, a consolidated subsidiary of Nippon Kayaku, is an optical film manufacturer established as a joint venture between our company and Arisawa Manufacturing Co., Ltd. It has maintained the top position as a maker of dye-type polarizing films for LCD projectors, vehicle-mounted displays, and other products. The production process for polarizing films used in LCD displays is divided into pre-processing, in which the original film is produced, and post-processing of the film for an LCD display or projector. Post-processing involves cutting the film, laminating it onto other materials, and inspection.

Companies are actively relocating this post-processing,



Plant of WPLC (China), a subsidiary of Polatechno, under construction

which is highly labor-intensive, to countries in the Asian region. Accordingly, in 2001 Polatechno relocated facilities for cutting, laminating, and inspection to Zhuhai near Hong Kong, and began construction of a 100,000-unit production system in autumn 2003. Even greater demand for our primary products, polarizing films for LCD projectors and vehicle-mounted displays, is expected. We will work to improve our local mobility by reinforcing our supply system both in Japan and overseas, while working to strengthen our cost competitiveness.

[Inflator Business]

Strengthened production of MGG and squibs in the U.S. and Europe

We are strengthening our production system in Japan, the U.S., and Europe – our three bases – for production of micro gas generators (MGG) and squibs (igniters) used in seatbelt pretensioners as well as inflators.

To promote our inflator business worldwide, Nippon Kayaku established Indet Safety Systems a.s. (ISS) (Czech Republic) in 1999 and LifeSparc Inc. (LS) (USA) in 2000. Together with our Himeji Plant (Himeji, Hyogo Prefecture), which manufactures automotive safety products in Japan, we have successfully established a tripartite production system. In the future, by strengthening our U.S. and Europe production systems, we aim to achieve a 30% share of the global market for both MGG and squibs in FY 2005. Currently, sales of products for the automotive industry account for slightly less than 10% of the total sales in the Fine Chemicals Group; however, it is forecast that this figure will rise to approximately 17% in 2004.



LifeSparc Inc., USA

Development of SCB squibs for commercialization

Nippon Kayaku is currently engaged in development aimed at commercialization of squibs (igniters) for next-generation airbag inflators that incorporate semiconductor technology. Using a semiconductor bridge (SCB) to ignite the squib makes it possible to achieve both low-energy ignition and high-speed operation.

Advances in the collision safety systems used to protect occupants in the event of a car crash result in more complex wiring and increased vehicle weight. For this reason, automobile manufacturers are working to develop lightweight high-precision bus wiring systems. Because these systems involve the effective operation of safety devices in response to a range of collision patterns, a network similar to a computer LAN is constructed inside the vehicle, and network communication is used to control ignition of the squibs. These bus system squibs, also known as "smart squibs," must conduct communications and at the same time be able to ignite using a small amount of energy contained in a component of the signal. For

this reason, the use of SCB is essential. SCB squibs, compared to conventional glass-sealed squib, plastic-sealed squib, and others that use nichrome wires, use only 1/25th of the electrical energy that conventional squibs require for ignition. Moreover, the reaction speed of SCB squibs is 10 times faster. Because of these and other advantages, SCB squibs are a key component of next-generation airbags.

Three years ago, Nippon Kayaku acquired a U.S. company that held patents relating to the use of SCB for squib ignition, and has since been working on commercialization of this technology. Samples of SCB squibs will be delivered to automobile manufacturers and airbag manufacturers starting in the winter of 2003, and we are continuing with development towards the goal of making SCB squibs the standard for smart squibs by 2008. By planning for early compatibility with the new bus wiring systems that are expected to expand rapidly in the future, we are constructing a superior position in the SCB squib field.

Inflator and Micro Gas Generator

◆ Inflator Mechanism

An inflator is a device, incorporated in safety airbags, that generates gas to instantly inflate the bag when a vehicle collision occurs.

[Operating mechanism]

- (1) A sensor detects the collision, and sends a signal to the inflator.
- (2) The squib inside the inflator operates, igniting a gas-generating agent. The generated gas enters the airbag, instantly inflating it.

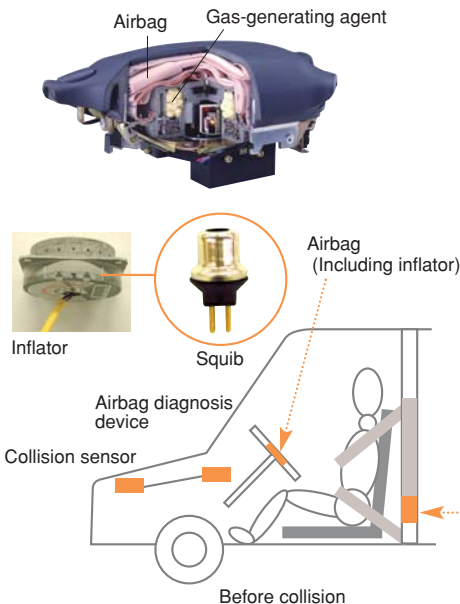
◆ Micro Gas Generator Mechanism

The micro gas generator for seatbelt pretensioner generates gas for the pretensioner device, which winds up the seatbelt and instantly restrains the occupant's body when a vehicle collision occurs.

[Operating mechanism]

- (1) A sensor detects the collision, and sends electric current to the micro gas generator.
- (2) The squib inside the micro gas generator ignites the gas generating agent. The generated gas pressure becomes the dynamic force that winds up the seatbelt.

Cross-section of steering wheel



Seatbelt pretensioner (Including micro gas generator)

