

# Research and Development

## R&D Activities

The Kuraray Group's R&D activities are tightly coordinated between corporate R&D and the divisional R&D activities conducted by our in-house companies, departments, and consolidated subsidiaries. R&D is guided at all levels by the Kuraray corporate mission to "apply highly innovative, high-quality technology to pioneer new business fields and contribute to society and the natural environment."

The GS-21 Medium-term Business Plan for fiscal years 2006 to 2008 aims to "shift R&D emphasis from quantity to quality to transform Kuraray into a specialty chemicals company capable of sustainable growth." The plan outlines a companywide policy to concentrate business development on our highly refined, high-performance materials and components focused in the promising growth fields of optics, electrical and electronics, automobiles, environmental products, energy, and health care.

In fiscal 2007, Kuraray appointed a Chief Technology Officer (CTO) to oversee the acceleration of R&D activities and fortify the technical capabilities throughout the company. Under the new CTO, we reorganized the development staff structure and narrowed the focus of our core development themes to augment our capability to apply selection and focus in our R&D activities. These moves increased our ability to identify high-potential themes for corporate R&D and enhanced our support system for new business creation.

The Corporate R&D division administers operations of the Kurashiki Research Laboratories, Tsukuba Research Laboratories, and Kuraray Research and Technical Center (USA). Divisional R&D activities are headed by R&D departments located on-site at each in-house company, division, and consolidated subsidiary. The R&D operations of the Kuraray Group (Kuraray and consolidated subsidiaries) employ 796 researchers and engineers.

R&D expenses totaled ¥15,250 million in fiscal 2007. R&D expenses by segment were: Chemical and Resins Business ¥5,260 million, Fibers and Textiles Business ¥2,712 million, and High-Performance Materials, Medical Products and Others Business ¥1,876 million. Corporate R&D expenses totaled ¥5,400 million.

## Primary R&D Activities

### Chemical and Resins

- Kuraray is a global leader in the vinyl acetate chain products of polyvinyl alcohol (PVA), polyvinyl butyral (PVB), and ethylene vinyl alcohol (EVOH resin), and closely coordinates the worldwide operations of its domestic and overseas R&D departments with a focus on development of new product applications, new products, and new production technology.
- In gas barrier materials, we are seeking to accelerate the development of application ranges for the newly developed gas barrier materials *EVAL SP* and *KURARISTER*. *EVAL SP* is a new EVOH resin offering a high level of flexibility, elasticity, and superior plasticity. *KURARISTER* is a new transparent barrier film for use in food packaging retorts. We are also developing markets for a variety of innovative products, such as super-barrier (scavenger) materials.
- R&D activities in thermoplastic elastomers focus on developing new applications and products, such as the *SEPTON V* Series offering enhanced resistance to heat and oil and the new *SEPTON Q* Series incorporating a new thermoplastic polymer suitable for designing polymer alloys that are light weight and exhibit excellent resistance to abrasion, scratching, and hydrolysis. Kuraray has applied its exclusive polymerization technology to produce the world's first mass production techniques for new acrylic thermoplastic elastomer materials featuring superb transparency, weather resistance, and plasticity and is advancing toward product commercialization.
- R&D in methacrylic resin concentrates on developing new products and applications emphasizing the distinctive properties of our polymers and in strategic areas for continuing business expansion in the electronic display industry.

### Fibers and Textiles

- R&D of *KURALON* and *KURALON K-II*, polyvinyl alcohol (PVA) fibers, is aimed at increasing the range of applications and expanding business for PVA as a high ductility concrete maintenance and reinforcement material as well as other applications. (*KURALON K-II* is registered under the technical name "PVA fiber for slope-surface mortar reinforcement" in the New Technology Information System (NETIS) of the Ministry of Land, Infrastructure, Transport and Tourism.) R&D

activities also focus on developing innovative fiber materials utilizing the company's unique compound fiber technology, such as the water-soluble fiber employing melt-spun material from the new *EXCEVAL* polymer. Recent advances include the successful development of *KURALON EC*, a new type of electro-conductive fiber utilizing a special metallic nanoparticle compound technology.

- We are developing new applications to exploit the high-strength, minimal moisture absorption, and low-creep characteristics of *VECTRAN*, the high-performance polyarylate fiber used in the air bags on the Mars exploration rover. We have also created five dope-dyed colors for *VECTRAN* that provide superior colorfastness against washing and in UV light and greatly reduced color bleeding when in contact with other spun fibers.
- R&D related to the man-made leather *CLARINO* centers on new product and application development for *PARCASSIO*, *AMARETTA*, and other man-made leather products. The company is also advancing R&D of the next generation, eco-friendly *TIRRENINA* to be produced using the Clarino Advanced Technology Systems (CATS), a completely renovated production process that is environmentally friendly and generates high quality and superior texture product. In the second half of fiscal 2007, Kuraray announced plans to construct a new mass production facility for *TIRRENINA* scheduled to commence operations in June 2009.

#### **High-Performance Materials, Medical Products and Others**

- R&D related to the heat-resistant polyamide resin *GENESTAR* aims at developing new products and applications to meet the growing demand for electrical and electronic applications and to keep pace with our steadily growing business in the automobile industry.
- We enhanced our presence in the water treatment field with the establishment in February 2007 of the joint venture *KURARAY AQUA CO., LTD.*, with Nomura Micro Science Co., Ltd. The company incorporates Kuraray's water purification technology using our hollow-fiber membrane and PVA gel wastewater treatment system with Nomura Micro's engineering technology. *KURARAY AQUA* is positioned to meet diverse needs in the globally expanding water treatment market.

#### **Corporate R&D**

- Corporate R&D seeks to create and foster new business in the anticipated growth fields of optics, electrical and electronics, automotive, environment and energy, and health care as well as in the wider landscape of electronic and optical materials and environment and energy.
- In the optics field, we are developing new high-precision processing technology and LCD display materials, such as the *MIRABRIGHT* multifunction light-guide plate. We are also aggressively conducting R&D activities related to next-generation products, including participating in the academic-industry alliance Technology Research Association for Advanced Display Materials (TRADIM) project to develop ultra-thin backlight units for next-generation mobile phones.
- Kuraray is at the forefront of the energy field and is advancing R&D activities of various new and innovative materials and products, including high-performance electrolyte membranes used in methanol-based fuel cells for which the market is expected to start expanding in the near future.
- R&D in the health care field is advancing the development of new orthopedic materials and other products with the aim of creating new businesses in medical-related fields. (Kuraray Medical Inc. will perform the R&D related to health care beginning in fiscal 2008.)
- The company is combining its new polymer electrolyte membrane and carbon material design technology developed from proprietary alloy, polymer design and synthesis technologies to produce a groundbreaking pliable electrode material. The material is capable of activation at electric voltage levels lower than has been possible with existing polymer actuators. We are developing the material with the aim of producing a new ion-conductive polymer actuator capable of stable performance in air.
- In the optoelectronics field, the Kuraray Luminas Co., Ltd., a joint operation of Kuraray and *TERCIA & Co., Ltd.* (formerly *T. CHATANI & CO., LTD.*), is progressing toward commercialization of products incorporating a white light source for LCD backlight using ultra-bright inorganic electroluminescence (EL) materials.