Showa Denko and its Group companies are promoting R&D in line with their medium-term consolidated business plan to establish technological advantages in the fields of electronics, fine chemicals, and new materials.

We are focusing on the three target markets of electronics, automotive parts, and personal care/environmental goods, allocating resources preferentially to growth driver businesses as well as new businesses covered by the six strategic market unit (SMU) projects for these market areas. We are continuing to pursue and improve synergies through the interconnection of our inorganic/aluminum and organic chemical technologies to establish ourselves as a unique chemical company with individualized products and capture new business opportunities.

Showa Denko and its Group companies invested ¥20,072 million (US$220 million) in R&D in 2008. A breakdown by segment of R&D efforts and investments during the year is as follows:

**PETROCHEMICALS**

In this segment, we are fully utilizing our proprietary technologies for catalysts, organic synthesis, and polymer synthesis to meet the needs of manufacturers of printing ink, paint, electronic materials, and automotive parts. We are improving catalysts for acetyl chemicals and allyl alcohol to further strengthen our competitiveness and increase production. As a result, our allyl alcohol production capacity has increased to 70,000 tons a year. We received the Chemical Society of Japan Award for Technical Development for 2007 for our development of acetic acid/ethyl acetate catalyst technologies. As for n-propyl acetate, an allyl alcohol derivative, we have completed its developmental stage and started commercial production. Furthermore, to meet growing demand for allyl alcohol to further strengthen our competitiveness and increase production, we have increased our production capacity to 70,000 tons a year. We received the Chemical Society of Japan Award for Technical Development for 2007 for our development of acetic acid/ethyl acetate catalyst technologies.

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**CHEMICALS**

To quickly meet wide-ranging customer needs, we are developing photosensitive materials, solder resists, high-performance gels, organic intermediates, and base materials for cosmetics.

Regarding photosensitive materials, we are developing a new multifunctional-thiol-based compound (Karenz MT™) and functional isocyanate monomers (Karenz MOI™-EG and Karenz AOI™) for addition to photo-curing resins as well as photo polymerization initiators to support the production of high-performance LCDs. We are developing performance polymer materials based on our proprietary monomers. Our new solder resist for flexible circuit boards in LCDs and mobile phones has been well received by the market. Thus, we have built a production facility for the new solder resists, while further developing its applications and new grades. We received the Tsukuba Foundation for Chemical and Bio-Technology’s award for our environment-friendly, halogen-free insulating resin developed jointly with the National Institute for Advanced Industrial Science and Technology (AIST) based on the achievements under a national project. Furthermore, we are working as a member of a national project for the development of basic technologies for green sustainable chemical processes.

In high-performance gels, we are expanding the variety of liquid chromatography columns. Development is under way for sample-preparation cartridges for the analysis of trace amounts of chemical substances. We are developing organic intermediates for agrochemicals and disinfectants by fully utilizing our position in raw materials. Meanwhile, we are developing new performance chemicals for use as base materials for cosmetics. The Chemicals segment’s R&D investment amounted to ¥1,510 million in 2008.

**ELECTRONICS**

We are accelerating the development of state-of-the-art technologies to meet the increasingly sophisticated market requirements. As for storage materials, we are continuing to develop new technologies as the world’s largest independent HD media manufacturer. We are producing HD media with higher performance using perpendicular magnetic recording (PMR) technology, which we have commercialized for the first time in the world. At the same time, we are developing discrete track media, the next-generation technology that will further increase the recording density, and making preparations for their commercialization. Using fourth-generation PMR technology, we started commercial shipments of 1.89-inch and 2.5-inch HD media with recording capacity of 120 and 250 gigabytes per disk, respectively, which represented the highest recording capacity for those sizes available on the market as of September 2008. In January 2009, we started commercial production of 3.5-inch, 500 gigabyte-per-disk HD media.
In display elements and materials, we are continuing to develop LED chips with higher brightness and power. As for indium gallium nitride (InGaN) LED chips, we have developed a proprietary Hybrid PPD™ (plasma assisted physical deposition) process and introduced a four-inch epitaxial wafer production line based on the process, thereby substantially improving the productivity. As for aluminum-gallium-indium-phosphide (AlGaInP) LED chips that emit red and yellow light, we are now able to provide high-performance LED chips for all wavelengths, ranging from ultraviolet to infrared. We will continue to improve their performances, developing such new applications as backlighting for large LCDs, large RGB displays, and white lighting. As for AlGaInP LED chips that emit red light, we attained, to the best of our knowledge, the world’s highest level of luminous efficiency as of May 2008.

We have been developing high-performance silicon carbide (SiC) epitaxial wafers for promising power device applications utilizing the results of joint R&D with AIST and the Central Research Institute of Electric Power Industry, providing high-quality epitaxial wafers of up to four inches in diameter through ESICAT Japan, LLP. To accelerate the expansion of the market and of our operation, we took over ESICAT Japan’s business at the end of 2008. We are developing high-capacity, high-voltage polymer capacitors mainly for PC and power source applications. In the area of neodymium-iron-boron magnetic alloys, we are meeting market requirements for high-performance magnets through sophisticated casting technologies and the better control of alloy microstructures. We are continuing to develop new materials that will maintain high levels of magnetic force at high temperatures to meet the needs of the automobile industry.

To serve the growing market for advanced displays and next-generation lighting, we are developing organic electroluminescent materials—based on an innovative phosphorescent polymer—and device structures. In semiconductor processing materials, we are developing chemical mechanical polishing (CMP) slurries for metal polishing at very small line widths and high-purity gases for etching, cleaning, and film formation. We are also developing high-purity chemicals for detergents and solvents as well as new charge dissipating agents for electron-beam lithography processes. The Electronics segment invested ¥8,944 million in R&D in 2008.

INORGANICS

Our development efforts in this segment focus on nanotechnology-based materials through the full utilization of our proprietary material/process technologies. Having established the world’s first volume production technology for VGCF™ carbon nanotubes, we are developing new grades with optimized fiber diameter/length and applications of the product in resin composites. Based on our many years’ experience in graphitizing, we have developed high-capacity graphite anode material for use in lithium ion batteries. The material is now being evaluated for use in large lithium ion batteries for automobiles. Meanwhile, we are developing applications of nanoparticle titanium oxide for use in multilayered ceramic capacitors and as slurry paste for dye-sensitized solar cells. We are also developing its applications in a visible-light-responsive photocatalyst for deodorant and stain-proofing agents as part of a national project. In addition, we are developing various functional ceramic fillers for heat sink applications. The Inorganics segment spent ¥1,055 million on R&D in 2008.

ALUMINUM

We are developing light, strong, and high-performance materials, parts, and products to meet market needs while conducting research on basic technologies pertaining to their production. Our proprietary forged alloys have been adopted by new customers in the automobile industry for use in compressors owing to the alloys’ light weight, high strength, and high formability. We are also developing new alloys jointly with automobile parts manufacturers. In the area of heat exchangers for car air conditioners, our NRT™ III condensers, using a new high-performance refrigerant tube technology, are being adopted increasingly in various new car models. We are developing next-generation products to reduce environmental impact. Furthermore, we are developing innovative heat exchangers based on new types of refrigerants to meet tighter environmental regulations in the future.

We are developing high-efficiency heat sinks for IT equipment and optical/power devices. We expect these heat sinks will develop into multifunctional electric/electronic parts. At the Aluminum Technology Center, we are improving our die technology for extrusion, forging, drawing, and press working; our process technologies for purification, fabrication, and bonding; as well as our simulation technology for structural and hot fluid studies. The Aluminum segment’s R&D investment amounted to ¥2,786 million in 2008.

COMMON R&D PROJECTS

Showa Denko’s Corporate R&D Center conducts basic research into new areas with a view to fostering new businesses and developing technologies common to different segments. The Analysis & Physical Properties Center and the Safety Evaluation Center support each segment’s R&D efforts by conducting analyses and investigations. In energy-related devices, we are conducting collaborative research for commercializing the carbon separators for polymer electrolyte fuel cells and platinum-substitute catalysts as part of national projects. Common R&D expenditures in 2008 totaled ¥3,887 million.