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 petrochemicals, fine chemicals, electronics, aluminum, and new materials.

We are focusing our R&D resources on 12 SMUs—market segments in which we can expect to achieve high growth by fully utilizing our core technologies. In particular, we are continuing to pursue and improve synergies through the interconnection of our inorganic/aluminum and organic chemical technologies in our aim to create individualized product lines and businesses.

Showa Denko and its Group companies invested ¥17,576 million in R&D in 2004. 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 catalyst technology to meet the needs of organic chemical manufacturers. In the area of acetyl chemicals, we are improving catalysts for the production of acetic acid and ethyl acetate to achieve top-level cost-competitiveness. We are also improving catalysts for the production of vinyl acetate and allyl acetate to further strengthen our competitiveness. As for the propylene-based product line, we are developing applications for our proprietary allyl ester resin, mainly in the area of optical materials. At the same time, we are developing other allyl derivatives for environment/IT-related applications. The Petrochemicals segment invested ¥2,396 million in R&D in 2004.

**CHEMICALS**
To quickly meet wide-ranging customer needs, we are developing high-performance gels, organic intermediates for disinfectants and agrochemicals, base materials for cosmetics, photosensitive resins, composites of photosensitive resins, and nano materials. In the area of high-performance gels, we are expanding the variety of liquid chromatography columns and accelerating the development of sample-preparation cartridges for analysis of trace amounts of chemical substances. We are developing organic intermediates for disinfectants and agrochemicals as well as new substances for photographic chemicals by fully utilizing our position in raw materials. We are also developing new materials for metal-organic chemical vapor deposition (MOCVD) processes on the strength of our functional molecular design technology.

Regarding photosensitive materials, we are developing photoimagable dry film type overcoats and waterborne etching resist inks for flexible circuit boards as well as photo initiators and functional monomers through our subsidiary Nippon Polytech Corp. We are also developing photosensitive master batches in which nanoparticles of surface-modified metal oxides are mixed with resins. We are aiming to develop applications in textiles having photocatalytic and ultraviolet shielding functions. The Chemicals segment’s R&D investment amounted to ¥2,137 million in 2004.

**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 a leading HD media manufacturer. Along with increasing the recording density of HD media by introducing longitudinal recording, we have commercialized a vertical recording technology. We are also developing small-diameter HD media for use in mobile applications.

In the area of display elements and communication device materials, we are continuing to develop LEDs with higher brightness and more diverse colors. We have developed a GaN LED with the highest level of brightness on the market, based on our proprietary technology and volume production process, and

Showa Denko’s 2.5-inch, 1.8-inch, and 0.85-inch HDs and consumer electronic devices containing HDDs
demand for it is expected to grow for white lighting applications. We are developing new grades of ultra-bright, aluminum indium gallium phosphide (AlInGaP) LEDs that emit red and yellow lights as well as laser-diode epitaxial wafers for optical pickups in DVDs. Development is also under way for myriametric-wave epitaxial wafers for use in next-generation communication devices.

Regarding solid conductive polymer aluminum capacitors, we are developing new grades with higher performance for PC applications. At the same time, we are developing other new applications by increasing capacitance and operating voltage.

In the area of neodymium-iron-boron magnetic alloys, we are meeting market requirements for high-performance magnets through sophisticated casting technologies and better control of alloy microstructures. We are also developing a high-performance thermoelement and parts for noise control devices by fully utilizing our alloy production expertise and related technologies.

To serve the growing market for advanced displays, we are developing organic electroluminescent materials, based on an innovative phosphorescent polymer, as well as energy-device applications for our VGCF and carbon nanotube products.

In the area of semiconductor processing, we are developing CMP slurries for metal polishing and high-purity gases for etching, cleaning, and film formation as well as for detergents and solvents. The Electronics segment invested ¥4,885 million in R&D in 2004.

INORGANIC MATERIALS
Our development efforts in this segment focus on nano materials. Having developed new grades of carbon nanotubes with optimized fiber diameter and length, we are developing applications of the product in the area of resin composites. The development of ultrafine particles of titanium oxide and zinc oxide is progressing for use in multilayered ceramic capacitors and as a photocatalyst. We are developing applications of nanoparticle titanium oxide for use as a visible-light-responsive photocatalyst for deodorant and stain-proofing agents and as slurry paste for dye-sensitized solar cells. Various functional ceramic fillers and advanced ceramics, including super abrasives, are being developed. The Inorganic Materials segment spent ¥386 million on R&D in 2004.

ALUMINUM
We are developing light, strong, and high-performance materials, parts, and products to meet market needs. For automotive applications, we placed on the market our forged suspension arms based on continuously cast high-quality aluminum alloy rod. We are developing alloys and forging processes for the production of automotive compressor parts and drive units. We are also developing thin-wall tubes and other components for small-sized, lightweight, and high-performance car air-conditioner heat exchangers. Also for automotive applications, we are developing new heat exchangers and sub-frames for next-generation, low-emission vehicles. In the area of environmental goods, we are developing components for energy devices and heat exchangers.

Regarding electronic applications, developments are continuing for high-capacitance, high-voltage aluminum foils based on our proprietary segregation solidification ingot technology for use in electrolytic capacitors. Furthermore, we started commercial production of innovative aluminum bottles. The Aluminum segment’s R&D investment amounted to ¥1,733 million in 2004.

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 the area of energy devices, we are conducting collaborative research for developing carbon separators for solid polymer type fuel cells as part of a national project. Common R&D expenditures in 2004 totaled ¥6,040 million.