CREATING HIGH-VALUE-ADDED PRODUCTS IN MAIN BUSINESS FIELDS

The Hitachi Chemical Group has identified key markets with high growth potential, including telecommunications, energy and life sciences. Supported by its broad technology platform developed over many years, Hitachi Chemical works to create new products used in these fields and improve its market share for core products. The following are some examples of these efforts.

TELECOMMUNICATIONS

“Anisolm” Anisotropic Conductive Films for Liquid Crystal Displays

Anisolm is a material used for interconnecting liquid crystal display (LCD) drive-use semiconductor chip-mounted tape carrier package (TCP) circuits and LCD panel circuits. Anisolm is composed of an insulating adhesive material with dispersed conductive particles and coated on a layer of film. When Anisolm is used to connect circuits, TCP and LCD panel circuits are electrically connected with the help of the conductive particles while preserving the insulation of adjacent circuits. This makes possible a precise connection, which was difficult using solder, a conventional connecting material, and Anisolm is thereby playing a major role in advances in LCD color displays and fine pitches on LCD panels.

In 1984, Hitachi Chemical Co., Ltd. became the first company in the world to commercialize anisotropic conductive film (ACF) with metallic particles dispersed in an adhesive film. Utilizing the know-how we have accumulated over the years, coupled with our technologies for resin design and synthesis, film structural design and reliability evaluation, we provide optimal solutions to meet customer needs. The Company holds the leading share of the global market for ACF, with 60 percent of the market (Company
estimate). Today, Anisolm has a level of recognition in the market that makes its name synonymous with ACF for liquid crystal displays.

In addition, Anisolm has been recognized for its significant contribution to the development and popularization of liquid crystal displays, receiving such awards as the Prime Minister’s Prize for Innovation from the Japan Institute of Invention and Innovation (JIII) and the SPSJ Award for Outstanding Achievement in Polymer Science in Technology from the Society of Polymer Science, Japan.

**CMP Slurry for High-Speed and Finely Selective Planarization of Barrier Metal**

Chemical mechanical planarization (CMP) is a technology designed for polishing and smoothing out an uneven surface on the dielectric film between the layers of circuits of semiconductors that results from mechanical processing. CMP slurry is widely applied in this process as a polishing material.

To meet the strong demand for faster semiconductor devices, circuit wiring material is shifting from aluminum to copper due to its lower electrical resistance property. Copper wiring is typically done by the following steps: 1) a groove is created in the dielectric film; 2) a barrier metal layer is formed to prevent the copper from spreading into the insulator; 3) the groove is filled in through copper plating; 4) the excess copper and barrier metal are planarized and removed through CMP.

Hitachi Chemical Co., Ltd. has been successfully offering CMP slurries for interlayer dielectric films to the semiconductor industry. Recently we developed a new slurry for planarizing copper wiring and barrier metal during the fourth step of the process described above. To date, we have won the global number-two position for our slurry for planarizing copper wiring, with 20 percent of the market (Company estimate). In particular, our slurry for barrier metal has received a positive response because it not only offers the optimal pH and other liquid composition for planarization, but also uses microscopic, high-purity abrasive particles, allowing the polishing process to become faster and to come to a halt automatically after planarizing the dielectric film layer in order to selectively planarize and remove the barrier metal.
Carbon Anode Materials for Lithium Ion Batteries

The lithium ion battery is a new type battery that can be recharged and reused over and over again. The lithium ion battery has approximately three times the voltage and a higher energy density than the nickel metal hydride (NiMH) battery. Consequently, it has been quickly adopted for mobile phones and laptop computers. The lithium ion battery operates based on the following principle: when the battery is charged, the lithium ions are stored in the anode, and when discharged, the lithium ions are released into the cathode. Therefore, the anode material is a very important element that influences the performance of the battery.

Relying on our long history of experience with carbon-related technology accumulated through the development of carbon brushes for motors, Hitachi Chemical Co., Ltd. has developed carbon anode material for a lithium ion battery. This material is massive artificial graphite powder with micro pores in its grain structure. This graphite powder is highly crystallized and has uniform properties. Compared to the lithium ion batteries adopting conventional materials, the battery adopting newly developed anode material offers higher capacity, minimizes capacity deterioration during high-current use, and maintains prime performance even at low temperatures. Our product’s superior performance has made the Company the number one manufacturer in the global market, with a 40 percent share (Company estimate).

Plastic Balance Shaft Gears

The balance shaft masks the vibration and noise of an in-line four-cylinder engine by creating vibrations on a different wavelength from the vibrations created by the engine. The gear that is attached to the balance shaft is generally made of metal for increased durability. However, there is a need to reduce the vibrations and noise created when the balance shaft gear engages with the crank shaft gear, which is also made of metal.

Hitachi Chemical Group company, Shin-Kobe Electric Machinery Co., Ltd. has developed the world’s first plastic balance shaft gear with longer durability using aramid reinforced fiber and polyaminoamide resin. Using plastic gears, we have not only been able to significantly reduce the amount of vibration and noise compared to the conventional balance shaft system, but have also simplified the assembly process by eliminating the need for a metal plate to adjust the gap between the gears.

Shin-Kobe Electric Machinery, together with balance shaft assembly manufacturer OTICS Corporation and friction damper manufacturer KOYO Seiko Co., Ltd., received the Toyota Engineering Development Award from Toyota Motor Corporation for a balance shaft system employing these plastic gears.
**GSO Single Crystal Scintillators for PET Equipment**

Positron emission tomography (PET) is a new type of diagnostic imaging technique that can detect microscopic cancerous cells not found by conventional imaging equipment. PET uses a specified radiopharmaceutical that tends to collect in cancerous cells. The radiopharmaceutical then emits gamma rays in symmetrical directions. In addition, the scanner in which the patient is lying detects and analyzes the rays in order to create an image of the location of the cancerous cells.

To detect gamma rays, which are invisible, it is necessary to transform them into fluorescent light by passing through a scintillator. Gadolinium silicon oxide (GSO) single crystal is adopted as a scintillator for PET equipment. Because it not only is more responsive to gamma rays and generates more fluorescent light, but also has a higher energy resolution compared to other single crystals, GSO crystal has contributed substantially to improving the speed and accuracy of PET equipment.

The GSO single crystal is manufactured and sold only by Hitachi Chemical Co., Ltd., which holds many patents related to its composition and manufacturing process. Consequently, we hold the number-three share in the global market for PET scintillators, with 20 percent (Company estimate).