

Ultrathin televisions: better
image quality, greater contrast
and less power consumption
thanks to PS-VA technology



PERFORMANCE MATERIALS

Liquid crystals from Merck are used around the world in LCD televisions, monitors, tablet PCs, notebooks, mobile phones, and digital cameras. Besides high-tech chemicals and materials for liquid crystal displays, the Performance Materials division also offers new lighting and display technologies such as OLEDs as well as innovative effect pigments for the plastics, printing and coatings industries. Our pigments are also used, for example, in skin care and color cosmetics. In view of climate change and high energy prices, we are also active in growth markets in the field of renewable energy sources. We are working to utilize solar energy more efficiently and to develop innovative technologies for energy-saving LEDs.

KEY PRODUCTS

- Icrystal® – Liquid crystal mixtures for displays
- Iriodin® – Pearl luster pigments for a wide range of color effects

FURTHER PRODUCT GROUPS

- Ixilux® – Materials for OLEDs (organic light-emitting diodes) in displays and for innovative lighting
- Ishape® – Efficient, eco-friendly materials for structuring solar cells and touch screens
- Innovative effect pigments, such as Xirallic®, which creates glitter effects, for use in coatings, packaging and product design, imparting not only decorative but also security-relevant features, such as brand and anti-counterfeit protection

KEY DEVELOPMENTS IN 2010

- Growing demand for high-tech liquid crystals: total revenues up 38% compared to 2009
- Technology leader in innovative liquid crystal mixtures, for example PS-VA (polymer-stabilized vertical alignment) technology
- Total revenues of the Pigments business unit rise by 37% compared to the 2009 crisis year
- Production capacity utilization at a high level for both liquid crystals and pigments
- Operating result more than doubled to EUR 580 million from EUR 218 million
- New Material Research Center inaugurated at the Darmstadt site; at EUR 50 million it represents the largest single R&D investment in the Chemicals business sector to date

STRENGTH BOOSTED

Merck has combined its materials businesses and activities in the new Performance Materials division, which was created after completing the acquisition of the U.S. life science company Millipore on July 14. The division consists of the Liquid Crystals, Pigments and Cosmetics business units, as well as Advanced Technologies, which offers materials for LEDs (light-emitting diodes) and photovoltaics along with other innovative technologies.

Production capacity utilization was at a high level for both liquid crystals and pigments, reflecting the recovery from the downturn in 2009. Total revenues of the division rose by 38% to EUR 1,384 million from EUR 1,006 million in 2009. Positive currency effects of 9.7% and organic growth of 27% contributed to this increase. The division generated more than 70% of its total revenues with liquid crystals. At EUR 925 million (2009: EUR 478 million), gross margin grew faster than expenses. Thus, the division's operating result more than doubled, increasing to EUR 580 million from EUR 218 million in 2009. Return on sales (ROS) rose to 41.9% from 21.7% in 2009. Underlying free cash flow amounted to EUR 549 million, compared to EUR 304 million in 2009.

Performance Materials | Key figures

EUR million	2010	2009	Δ in %
Total revenues	1,384	1,006	38
Gross margin	925	478	93
R&D	127	109	17
Operating result	580	218	166
Exceptional items	-1	1	-
Free cash flow	542	288	88
Underlying free cash flow	549	304	81
ROS in %	41.9	21.7	

At EUR 50 million, the new Material Research Center in Darmstadt is the largest single R&D investment in the Chemicals business sector to date

In order to defend and expand our leadership position in display materials, among other fields, we continued to invest in research and development. R&D spending rose to EUR 127 million from EUR 109 million in 2009. In September, the new Material Research Center was opened at the Darmstadt site. At EUR 50 million, this represents the largest single R&D investment in the Chemicals business sector to date. Covering a surface area of approximately 11,000 square meters, it houses some areas of liquid crystal research as well as OLED (organic light-emitting diodes) research, among other activities. Our researchers at the center are also working on materials for mobile energy storage systems, for example for use in hybrid or electric vehicles.

LIQUID CRYSTALS

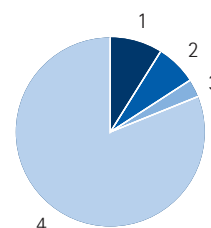
Upturn sustained

As a result of the growing demand for high-tech liquid crystals from Merck, total revenues increased in 2010 to EUR 1,013 million, which is 38% more than in 2009. The quarterly development of Liquid Crystals also reflects the rapid recovery of the global business for liquid crystal displays (LCD) after the crisis-related drop in 2009. Quarterly business performance continued to improve in 2010, with a 50% rise in revenues in the second quarter, reaching a record level of EUR 284 million. In the first half of 2010 alone, total revenues increased over the same period in 2009 by 63% to EUR 523 million. The operating result increased fourfold to EUR 263 million. Although still at a high level, total revenues were slightly lower in the third and fourth quarters. This was the result of the onset of inventory corrections in the LCD market, with display manufacturers reducing their production, as well as slightly unfavorable exchange rates.

Performance Materials | Sales by region

EUR million / % of divisional sales

1 Europe	127	9%
2 North America	99	7%
3 Latin America	33	3%
4 Asia, Africa, Australasia	1,118	81%



New technologies such as LED backlighting, 3D functionality and Internet connectivity are setting the trend in the television market

The market research firm DisplaySearch forecasts annual global shipments of over 268.8 million liquid crystal (LCD) televisions by 2014. The higher demand for LCD televisions is closely linked with new technologies such as LED backlighting, 3D functionality, and Internet connectivity.

Strong demand for liquid crystals based on PS-VA technology added crucial impetus to business

New display technologies continue to advance

The overall significant increase in total revenues in 2010 and the high capacity utilization of our LC production was largely due to the strong demand for liquid crystals based on the patented PS-VA (polymer-stabilized vertical alignment) technology, with which Merck further expanded its technology leadership. Besides improved moving picture quality, the technical advantages of PS-VA are faster switching times, higher contrast and better brightness with lower energy consumption.

PS-VA technology opens up new possibilities for LCD producers to achieve previously unattained screen properties – warmer, more natural colors, spatial depth and livelier movement. In Taiwan, South Korea and Japan, this technology is already being used in mass production. The term LED TVs is used to describe LCD televisions in which only the backlight consists of LEDs (light-emitting diodes), thus improving picture contrast, reducing energy consumption and producing more lifelike images. Individual areas of the illuminated surface for displaying a deep black can be separately dimmed or switched off completely, thus enhancing the contrast. This combines the advantages of LED and LCD. Further significant advantages include the low energy consumption and slim design of the flat screens.

Liquid crystals for 3D televisions and tablet PCs

In addition, Merck supplies innovative liquid crystal mixtures needed for devices such as 3D televisions and touch screens used in tablet PCs, which are becoming more and more popular. The liquid crystal mixtures used for special 3D glasses for watching 3D television contributed to the positive business performance, as did light-converting isiphor® phosphors used for LED backlighting.

In addition, we are working on reactive mesogens, which are polymerizable liquid crystals that can be used, for example, as material for optical films. They help to enhance the image quality and improve the power consumption of 2D and 3D screens.

New Liquid Crystals research center in South Korea

With the inauguration of the Advanced Technology Center in Poseung, South Korea, we have created additional possibilities to research and develop the latest liquid crystal technologies and have laid the foundations for further innovations. We invested EUR 11 million in this research center.

OLED technology is progressing rapidly

OLED technology for more energy-efficient light

Besides liquid crystal technology, our researchers are also working on materials for innovative displays. Here the special focus of development is on OLED materials, which are already being used in mobile phones and MP3 players. In our efforts to advance OLED technology, we are increasingly participating in research networks. The development of "new materials for OLEDs from solutions" (NEMO) is the focus of a project in which Merck is participating as the consortium leader together with partners from industry and science. The aim of this collaboration, which is funded by the German Federal Ministry of Education and Research, is to develop innovative, soluble materials for use in large-area OLED components for applications such as flat screens, electronic traffic signs or lighting systems.

OLEDs are solid-state devices composed of thin films of organic semiconductor molecules that create light when electrical current is applied. OLED tiles are produced on glass plates or flexible substrates and can emit white light that is more homogeneous and more energy-efficient than the light from conventional fluorescent lamps. The main difference to inorganic light-emitting diodes (LEDs) is their lower current density and laminar light density and the fact that no crystalline materials are required. They consume little energy and offer sharp images from nearly every viewing angle. By using ultra-thin luminescent layers, OLED technology makes it possible

to produce unique, large-area, homogeneous lighting surfaces with a total layer thickness of just a few millimeters.

Compared to the vacuum evaporation process used today, these new materials should significantly improve scalability, structurability and coating efficiency in particular. To this end, the NEMO project partners are focusing on soluble, phosphorescent materials for red, green and blue applications. In order to develop marketable solutions quickly, different injection, transport and electrode materials as well as adhesives are being researched, evaluated and tested for their performance in parallel. In addition, as the leading producer of high-performance OLED materials, Merck is collaborating with Braunschweig Technical University and the U.S.-based company Applied Materials on a project called "Light InLine" to develop processes to reduce the production costs of OLED lighting.

Photovoltaics – a key technology

Photovoltaics are one of the key technologies with respect to renewable energy sources. In this field, the Performance Materials division is focusing on the development of materials and printing technologies for solar cell production.

With the isishape® range, we already offer the producers of crystalline solar cells printable structuring materials that improve solar cell efficiency and enable eco-friendly production processes.

Flexible solar cells – new approaches
in material development

Our material platform Ilicon® offers customers organic semiconductors for printed, flexible and robust organic photovoltaic (OPV) cells. Developing materials further to increase solar cell efficiency is the key to reaching mass markets. To this end, Merck is collaborating with other leading industrial companies on a development project sponsored by the German Federal Ministry of Research and Education. This project aims to achieve fully printed, flexible solar cells with a minimum of 10% efficiency by 2012. At our Technical Centre in Chilworth, near Southampton, United Kingdom, we are focusing intensely on these goals.

In parallel, we are working with leading partners worldwide on new technologies, for example dye-sensitized solar cells. These imitate nature's photosynthesis process. The electrolytes in the dye-sensitized solar cells are increasingly based on the use of ionic liquids, in whose development and manufacture Merck has a globally leading role. The use of ionic liquids creates the possibility to produce both rigid and flexible solar cells with high efficiency and stability. This special feature will enable us to develop many new fields of application in the future.

Scientific alliances

Together with the University of Freiburg, we launched a project in November to develop and produce new battery materials. The Merck Battery Materials Lab, which is jointly run and operated with the university, is working to develop fundamentally new conductive salts for lithium-ion batteries to power hybrid and electric cars.

With such concept labs, Merck has been pursuing a new approach since 2006 aimed at building strong alliances with external and internal partners and an international research and technology network. These concept labs are an important element of the Advanced Technologies (AT) unit of the Performance Materials division. The goal of this unit is to develop innovative products through to market launch with the use of new promising technologies.

The concept labs are located at hot-spots of academic research around the world and focus internationally on strategic growth areas within the chemical industry. The systematic use of in-house expertise and the core competencies of Merck create the preconditions for generating new technologies and innovative products for Merck's Chemicals business. At the same time, external knowledge as well as in-licensing, cooperation and promotion possibilities are utilized. Merck concept labs are located in Darmstadt, Heidelberg, Atsugi (Japan), and Boston (United States).

Additionally, Merck is cooperating as part of a network of German companies and universities to develop concepts for the economical mass production of organic electronic circuits, storage devices and sensors, power generation through organic photovoltaics, as well as energy conservation through the use of more economical organic light-emitting diodes. To implement the project, the pacesetter partners have established a common platform, namely InnovationLab GmbH based in Heidelberg.

PIGMENTS / COSMETICS

Upswing also due to the marked increase in demand from the automotive industry

Recovery from the drop in demand

The Pigments business recovered well from the weak global demand in 2009. Total revenues of the Pigments business unit in 2010 amounted to EUR 325 million, which is 37% more than in the 2009 crisis year. Total revenues were especially high in the third quarter. This upswing was due to the marked increase in demand in the automotive industry, which returned to, or even exceeded, pre-crisis levels. With effect pigments for automotive coatings, Merck is an important supplier to the industry.

Demand for consumer goods revived following a long period of consumer restraint. This favorably impacted the business with pigments for plastics, print products and cosmetic products, as did the generally positive consumer sentiment. Positive currency effects provided an additional boost to the business unit.

We also continue to focus our innovation efforts on profitable pigments such as Candurin® pigments for coating foods and pharmaceuticals, and on the Pyrisma™ line of products, which covers a wide color range and offers intense effects.

Full capacity utilization

The generally strong order situation resulted in a return to full production capacity utilization in March 2010. We shifted some of our standard pigment production from Onahama in Japan to Gernsheim in Germany so that we could expand capacities for Xyrallic® pigment production at the Japanese site. The reason for this is the strong demand for these pigments containing aluminum oxide flakes – particularly from the automotive industry.

Additionally, in October we laid the cornerstone for the construction of a new plant to produce Meoxal™ at the Onahama site in Japan. Commercial production of Meoxal™, an effect pigment based on aluminum flakes coated with metal oxide, is scheduled to start in 2012. The pigment is distinguished by high color saturation, good hiding power and superior corrosion resistance. High demand is expected particularly from the automotive and cosmetics industries. By completing the integration of Suzhou Taizhu Technology Development, the leading supplier of effect pigments in China, we further expanded our position in the fast-growing Chinese market. The acquisition in 2009 gave us the possibility to more actively target the mid-range price segment with an expanded range of products.

New cosmetic applications

Portfolio of functional fillers for cosmetics significantly expanded

In 2010, Merck significantly expanded its portfolio in both cosmetic functional fillers and in the core pearl luster pigments business. With RonaCare® Cyclopeptide-5, Merck introduced the world's first cyclic peptide for the cosmetics industry. Thanks to its cyclic molecular design, the active ingredient displays high stability and high selectivity for its biological target site in the skin. The peptide is capable of reactivating the decelerated repair processes of mature skin and stimulating its natural regeneration. The appearance of lines and wrinkles is reduced after just brief use. The skin becomes significantly more supple, elastic and firm.

Scratch-resistant automotive coatings based on nanotechnology

The innovative additive Tivida™ has provided additional impetus. Based on nanotechnology, this product improves the scratch resistance of automotive coatings. The additive can be perfectly incorporated into the composition of the binding agent, thus changing its structure. The nanoparticles make the solvent-based coating system harder and at the same time more elastic due to the cross-linking of the polymer shell with the binding agent. Tivida™ provides the desired protection against scratches long after a fresh coating is applied, lasting throughout the subsequent use of the coated item. Tivida™ AS 1010, the first product in the brand family, makes it possible to protect high-gloss surfaces, for example the majority of clear coatings used in the automotive industry, against minor everyday scratches much longer than previously possible.

For plastics laser marking, Merck offers Micabs®C 431 and Micabs®C 411, two new additives in granulate form. They are free from heavy metals and thus approved for laser marking of food packaging as well as for toy production.