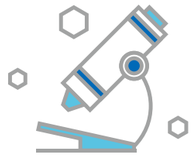
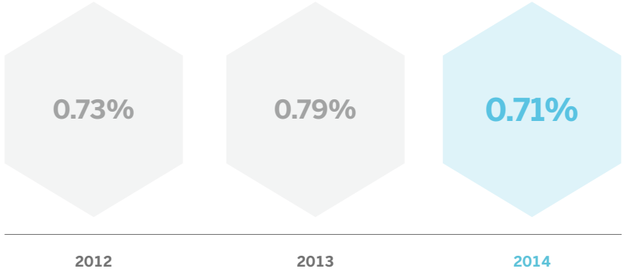
Research & Business Development

At KKPC, we know that research and development is at the core of both our competitiveness and future. Our R&D efforts span a broad range of areas from product quality improvement and market-leading technical development to productivity improvement and manufacturing cost reduction. Through organic collaboration between production, research, marketing, and all other areas of our operations, we are working hard to ensure that our R&D advances make a meaningful difference to the bottom line.

R&BD Investments

as percentage of sales





R&BD Organization // We refer to our R&D activities as “R&BD” or research and business development to reflect the common sense idea that business strategy as well as potential market needs must be taken into account from the R&D planning phase to ensure that each project makes a concrete contribution to corporate strategy. Our R&BD activities revolve around the Kumho Petrochemical R&BD Center in Daejeon, which focuses on the fields of synthetic rubbers, synthetic resins, next-generation materials, and the Kumho Electronic Materials Laboratory in Asan, which focuses on advanced, value-added materials for the semiconductor and display sectors.

Kumho Petrochemical R&BD Center // We opened our first R&DB center along with our Ulsan plant in 1973 to strengthen our foundation in the synthetic rubbers field, expanding research over time into the specialty chemical and polymer fields. In 1994, the center moved to its current location at a new campus in Daejeon. Since then, it has steadily expanded its activities to cover strategic new fields and become one of Korea’s top general materials research centers.

Kumho Electronic Materials Laboratory // We opened this laboratory in 1998 in conjunction with our entry into the semiconductor chemicals field with the completion of our Asan plant. This co-location has enabled us to bring new products to market and improve the quality of semiconductor processing materials such as BARC (bottom anti-reflective coatings) and PSPI (photosensitive polyimide) as well as LCD sealants and other materials for the display industry. The center has registered more than 200 patents in the photoresist field alone, winning recognition for its technical capabilities as it partners with global semiconductor makers to develop products that meet their specific needs.

Major Innovations

1

High-Performance SSBR Grades

With rising demand for eco-friendly tires and tire labeling requirements becoming increasing common, demand for SSBR (solution styrene butadiene rubber), a material recognized for its superior silica filler dispersion characteristics, is growing rapidly. We now produce a variety of SSBR grades that are expected to generate our strongest sales growth in the coming years. Through this project, we have acquired proprietary manufacturing technologies for synthetic rubber denaturant, polymer structure control, and new compounds that enable us to develop and produce unique SSBR grades with superior properties.

2

Bio-Based Polyester Polyols

Rising energy consumption and climate change have spurred the global chemical industry to actively develop eco-friendly polyols. The auto industry already produces polyurethane from NOP (natural oil-based polyols) for seat foam and is now working to do the same for interior components such as headrests and armrests. NOP is also beginning to be adopted to produce the slab stock foam used in memory foam bed mattresses. We have developed bio polyols for automotive mold foam applications and are currently exploring ways to expand sales to the furniture industry.

3

Mono-Styrenated Phenols

Also known as MSP, this low-viscosity phenol paint diluent was developed as a replacement for hormone-altering phthalates. We have continued to improve the quality of our product since launching sales in 2009. Looking ahead, we are now developing and exploring applications for a new product known as MSP500 for low-VOC high-performance coatings that deliver excellent consistency for epoxy and urethane paints without impacting compounding properties.

4

LEADCAP Warm-Mix Asphalt Additive

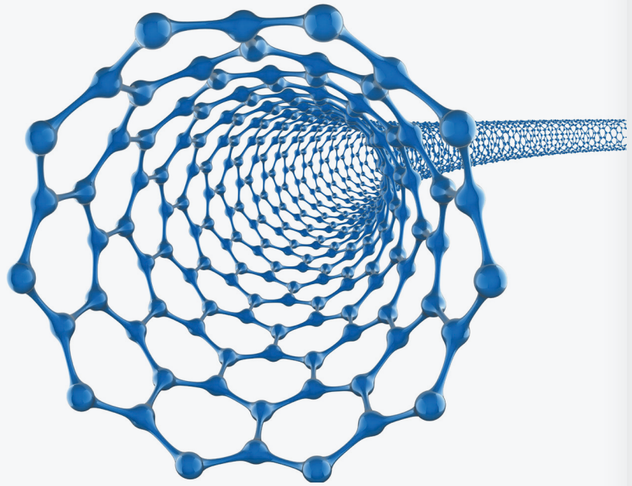
Launched in 2014, LEADCAP (low-energy and low-carbon dioxide asphalt pavement) is a WMA (warm-mix asphalt) additive that can also be used at existing hot-mix asphalt plants. A 1.5% mixture of LEADCAP allows the production temperature of the asphalt mixture to be reduced by approximately 30°C, resulting in significant reductions in both energy usage as well as emissions. These advantages earned LEADCAP a special environmental certification from the Korea Environmental Industry & Technology Institute (KEITI) in 2014.

Major Innovations

5

Carbon Nanotube Products

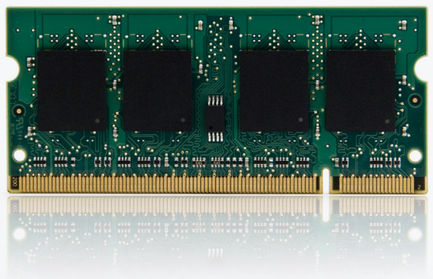
This high-value-added material has applications across a wide range of fields including semiconductor packaging, home electronics, automobiles, electromagnetic shielding, and heat shielding and dispersion. We completed and began commercial production at our carbon nanotube plant in 2013. We continue to pursue research to improve performance as well as develop new products for high-purity, olefin compound, conductive sheet, home appliance, and automotive applications to generate new value in our core synthetic rubbers and resins businesses.



6

Photosensitive Polyimide

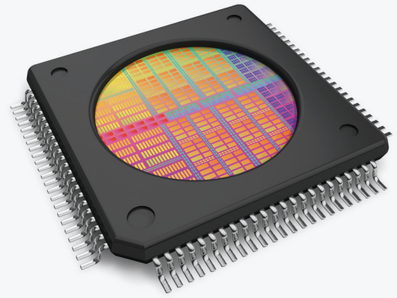
PSPI (photosensitive polyimide) is an exceptionally reliable protective packaging material applied underneath the epoxy molding compound layer and above the semiconductor passivation layer to protect chips from heat, radiation, and pressure. We completed PSPI development in 2012 and extended our technology to DRAM applications in 2014 with enhanced sensitivity, chemical resistance, and corrosion resistance. With demand for redistribution line technology expected to grow, we are now working on PSPI products for OLED pixel membranes and other advanced applications as we expand our product lineup.



7

ArF Immersion Photoresist

In 2014, we completed commercialization of an ArF (argon fluoride) immersion photoresist, leveraging our technical background in ArF photoresist to deliver this upgraded material to reduce the size and improve performance of semiconductor chips. We launched development of ArF photoresist in the early 2000s and began commercial production in December 2005. The new ArF immersion photoresist gives us new momentum as we accelerate development of next-generation photoresist materials.



8

ArF Immersion BARC

BARC (backside anti-reflective coatings) are polymer coatings used on the lower layer of photoresist to control light reflection in high-resolution lithography. Since the launch of commercial production of KrF BARC in 2008, we have been developing ArF immersion BARC products to satisfy the semiconductor industry's demand for higher chip densities and performance. We began commercial production in December 2014 and expect this technology to play a key role in our development of future high-performance BARC products.