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Most figures in this report are converted from KRW into USD based on yearly average exchange rates. But growth rates (e.g. CAGR and YoY growth rate) are calculated based on KRW to prevent any distortion caused by changes in exchange rates.
Definition of the Industry

Definition, Scope, and characteristics

The chemical industry is part of the manufacturing industry whose production involves chemical processes such as synthesis, decomposition, polymerization and fermentation.

- The number of product types that fall under the chemical industry is over tens of thousands.

The chemical industry is the largest sector in the entire manufacturing industry, in terms of market size and scope. Its classification may vary according to chemical substances and product use, differences in production system/materials/technology, production size, and product performances.

Upstream and downstream of the fine chemical industry and related industries

This report particularly focuses on highly functional polymers (e.g., engineering plastics (EP), carbon fiber materials for electric and electronic devices such as secondary battery, semiconductor, and display) that are gaining traction in the new era of the Fourth Industrial Revolution.

- As such, this report will mainly deal with some of the specialty chemicals (fine chemical materials) that are essential in the development of Korea’s chemical industry.

The specialty chemical industry is a value-added, technology-intensive industry that has far-reaching economic impacts, enabling related industries to have more sophisticated functions and higher-added values. The specialty chemical industry helps the manufacturing sector to strengthen competitiveness and create jobs.
Specialty chemistry consists of small markets of diverse items excluding EP and others.

- For their short life cycle, timely production and supply of products that meet the demand of the upstream industries is crucial.

The global demand for specialty chemicals is on the rise, as materials are becoming more important in improving the functionality and performance of more sophisticated and advanced finished products.

Status of the Industry

Status of the Global Market

According to the European Chemical Industry Council (CEFIC), the market size of the global chemical industry (excluding oil refinery and medicine) recorded an annual revenue of EUR 3.63 trillion (approximately USD 4.19 trillion) in 2015, which is slightly smaller than ACC.

Revenue Proportion of Chemicals by Continent (2015)

According to the report by Korea Institution for Industrial Economics and Trade (KET) released in December 2016, the global specialty chemicals market\(^1\) recorded USD 1.57 trillion in 2015 and will grow by 4.6% annually to reach USD 2.45 trillion by 2025.

Trend and Forecast for the Market Size of Global Specialty Chemicals

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Total (a+b+c)</td>
<td>2,771</td>
<td>4,461</td>
<td>6,087</td>
<td>7,536</td>
<td>8,517</td>
<td>8.2</td>
<td>3.4</td>
</tr>
<tr>
<td>Petrochemistry</td>
<td>1,076</td>
<td>1,809</td>
<td>2,326</td>
<td>2,851</td>
<td>3,217</td>
<td>8.0</td>
<td>3.3</td>
</tr>
<tr>
<td>- EP</td>
<td>122</td>
<td>354</td>
<td>470</td>
<td>575</td>
<td>692</td>
<td>14.4</td>
<td>3.9</td>
</tr>
<tr>
<td>- Others</td>
<td>954</td>
<td>1,455</td>
<td>1,856</td>
<td>2,276</td>
<td>2,525</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fine Chemistry</td>
<td>897</td>
<td>1,426</td>
<td>1,998</td>
<td>2,584</td>
<td>3,128</td>
<td>8.3</td>
<td>4.6</td>
</tr>
<tr>
<td>- Agricultural Chemistry</td>
<td>191</td>
<td>364</td>
<td>458</td>
<td>542</td>
<td>725</td>
<td>9.1</td>
<td>4.7</td>
</tr>
<tr>
<td>- Consumer Goods</td>
<td>286</td>
<td>386</td>
<td>445</td>
<td>520</td>
<td>646</td>
<td>4.5</td>
<td>3.8</td>
</tr>
<tr>
<td>- Highly Functional Materials</td>
<td>420</td>
<td>676</td>
<td>1,095</td>
<td>1,522</td>
<td>1,757</td>
<td>10.1</td>
<td>4.8</td>
</tr>
<tr>
<td>Others</td>
<td>798</td>
<td>1,226</td>
<td>1,763</td>
<td>2,101</td>
<td>2,172</td>
<td>8.3</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Source: Growth rate forecast by the Korea Petrochemical Industry Association (KPIA) (Sep. 2016) based on the ACC’s Year-End 2015 Chemical Industry Situation and Outlook; Partially reestimated by the Korea Institute for Industrial Economics and Trade (KET) based on EBN Chemical News (Mar. 19, 2016), “Hanhwa Joins the Emerging Engineering Plastics Market.”

Note: “Others” include many items not included in either petrochemistry or fine chemistry.

- With the increasing dissemination of smart devices, a rapid growth is observed in the electric, electronic, and automotive materials (e.g. petrochemical and lightweight materials such as carbon fiber and PPS\(^2\)) as well as eco-friendly materials (e.g. materials for bio plastics, solar power and fuel cell).
- In terms of compound annual growth rate, specialty chemicals are growing at a faster pace than the entire chemical industry (3.4%) and general-purpose products (3.1%).

\(^1\) Specialty chemicals are defined in a narrow sense as a combination of engineering plastics (EP) and highly functional materials. If defined in a broad sense to include agricultural chemicals and consumer goods, the CAGR of specialty chemicals during the same period is 4.5%.

\(^2\) PPS refers to polyphenylene sulfide, a thermoplastic generally sold as a compound of fiberglass and mineral filling. It is a super EP polymer with exceptional resistance to temperature, impact, humidity, and electric insulation.
Status of the Korean Market

Overview

The success of the first 5-Year Economic Development Plan accelerated the growth of upstream industries that use petrochemical products as raw materials including textile, shoes, plastic, tires, and detergent.

With the sharp growth of light industries (e.g. textile, shoes, and plastics) as well as upstream industries (automotive, electronics, shipbuilding, and construction), the Korean chemical industry rapidly grew.

In particular, Korea established diplomatic relations with China in 1992 and gained access to the largest market in the world. Surged exports to China opened a new chapter for the dramatic growth of the Korean chemical industry.

Engineering plastic (EP) was introduced in the petrochemistry sector over 30 years ago and has been commoditized since. Meanwhile, super engineering plastic (super EP), which performs remarkably better than traditional EP, has been recently introduced and developed under the leadership of major petrochemical firms in Korea.

Global Standing

According to the American Ceramic Society (ACS), the top 10 global chemical industry in terms of market size was China, US, Japan, Germany, South Korea, India, France, UK, Switzerland, and Italy. Korea is established as the fifth largest chemical market in the world.

Korean Chemical Industry's Production and Proportion to Manufacturing Industry

<table>
<thead>
<tr>
<th>Year</th>
<th>Manufacturing (A)</th>
<th>Chemicals (B)</th>
<th>Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>792.5</td>
<td>68.3</td>
<td>8.6</td>
</tr>
<tr>
<td>2008</td>
<td>891.6</td>
<td>79.6</td>
<td>8.9</td>
</tr>
<tr>
<td>2009</td>
<td>963.5</td>
<td>85.0</td>
<td>8.8</td>
</tr>
<tr>
<td>2010</td>
<td>1,176.3</td>
<td>103.7</td>
<td>8.8</td>
</tr>
<tr>
<td>2011</td>
<td>1,304.4</td>
<td>135.1</td>
<td>10.4</td>
</tr>
<tr>
<td>2012</td>
<td>1,411.8</td>
<td>122.8</td>
<td>8.7</td>
</tr>
<tr>
<td>2013</td>
<td>1,417.2</td>
<td>153.4</td>
<td>10.8</td>
</tr>
<tr>
<td>2014</td>
<td>1,354.7</td>
<td>141.5</td>
<td>10.4</td>
</tr>
</tbody>
</table>

Source: Statistics Korea, KOSIS Mining & Manufacturing Statistics DB

Note: The chemical industry is based on Korean Standard Industrial Classification (KSIC) 10 (chemicals and chemical products; excluding medicine)

3) Chemical & Engineering News (July 27, 2016), "Cover Story: C & EN’s Global Top 50"

4) Industrial and trade statistics classifications do not distinguish between general and specialty products.

Four Korean companies — LG Chem (11th), Lotte Chemical (25th), SK Innovation (41st) and Hanwha Chemical (45th) — ranked among the world’s top 50 chemical companies in 2015.5
In 2014, the chemical industry took up only 9.2% of production and 8.6% of added value of the entire manufacturing sector. Its share in the exports market was 9.7% in 2016.

### Standing of the Korean Chemical Industry (2014)

<table>
<thead>
<tr>
<th>Production (USD billion)</th>
<th>No. of Companies (EA)</th>
<th>No. of Workers (People)</th>
<th>Added Value (USD billion)</th>
<th>Export (USD million)</th>
<th>Trade Balance (USD million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>141.46</td>
<td>2,690</td>
<td>125,688</td>
<td>37.84</td>
<td>48,320</td>
<td>21,553</td>
</tr>
<tr>
<td>(10.4)</td>
<td>(3.9)</td>
<td>(4.3)</td>
<td>(8.6)</td>
<td>(9.8)</td>
<td>(24.1)</td>
</tr>
</tbody>
</table>

Source: Same as above

Note: 1) As of 2014; export and trade balance are as of 2016
2) Figures in the parentheses indicate the share of chemicals in the manufacturing sector, except for export and trade balance, where the shares are compared to the entire export.

In 2014, the market size of basic petrochemical materials in the organic chemical industry was the biggest in the entire chemicals industry, with its production amounting to USD 42.38 billion. Synthetic resin and other basic organic compound followed the list, with USD 32.06 billion and USD 14.91 billion, respectively.

Cosmetics, the biggest segment in inorganic chemicals, recorded the next largest amount of production with USD 7.37 billion. The cosmetics segment is rapidly growing on the back of the recent Korean Wave spreading in China and Southeast Asia.\(^5\)

- The cosmetics segment is subsequently followed by basic inorganic chemical materials (USD 7.06 billion), paint and ink (USD 5.68 billion), dye and pigment (USD 2.22 billion), synthetic rubber (petrochemistry, USD 2 billion) as well as adhesive and gelatin (inorganic chemistry, USD 1.74 billion).

### Export and Import

In 2016, the export and import of Korea’s chemical industry stood at USD 48.32 billion and USD 26.77 billion respectively, down 0.1% and 4.3% YoY.\(^6\)

The biggest export item in the petrochemical segment (based on 4-digit HS code) in 2016 was synthetic resin (USD 18 billion), followed by basic oil components and intermediate materials (USD 10.46 billion), synthetic materials and other petrochemical products (USD 7.1 billion), and synthetic rubber (USD 791 million).

- The biggest export item in the fine chemical segment in 2016 was “others” (USD 5,599 million), followed by cosmetics (USD 4.21 billion), inorganic chemical materials (USD 3.53 billion), dye and pigment (USD 1.32 billion), paint and ink (USD 833 million), and information electronic materials (USD 634 million).

The biggest import item in the petrochemical segment in 2016 was synthetic materials and other petrochemical products (USD 7.66 billion), followed by synthetic resin (USD 4.28 billion), basic oil components and intermediate materials (USD 2.76 billion), and synthetic rubber (USD 488 million).

- The biggest import item of fine chemistry in 2016 was inorganic chemical materials (USD 5.37 billion), followed by others (USD 4.11 billion), cosmetics (USD 1.78 billion), dye and pigment (USD 1.62 billion), information electronic materials (USD 1.48 billion), and photographic chemicals (USD 799 million).

### Global TSI Trend of the Korean Chemical Industry by Year

The following figure shows the Trade Specialization Index (TSI)\(^7\) of Korea’s chemical industry by year.

- In a nutshell, the Korean chemical industry has a comparative edge in exports.

5) Over the recent years, the Korean cosmetics industry has recorded a sharp annual growth of over 10%. Its exports soared by 54% annually and the number of businesses increased by 40% to reach 3,840. Gyeong Jin Cho (Nov. 2016), “How to Overcome Risk Factors of Cosmetics Industry of Korea for the Sustainable Growth,” 「Research」, Korea Development Bank (KDB).
6) In terms of volume, exports increased by 1.6% and imports decreased by 0.9%.
7) (X-M)/(X+M), where X and M mean export and import.
**Current Standing and Prospect of Korean Chemical Sectors**

**Functional Coating Materials**

**Current Standing**

Korean coating companies have improved their technological capacity through in-house R&D. They secured general-purpose functional coating technologies (except for manufacturing technologies and some highly functional special coatings) comparable to the companies of advanced countries.

KCC Corporation Co., Ltd. is the biggest paint company in Korea. Through the development and supply of functional coating materials as well as strict on-site work and supervision, the company has successfully completed coating projects on over 3,000 newly built and 4,500 used ships. As of 2013, KCC Corporation is the biggest container coating provider in the world, having coated 6.5 million Twenty-foot Equivalent Unit (TEU) of steel cargo containers.

**Production Status and Prospect of Korean Functional Coating Materials (USD million, %)**

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Raw Materials</td>
<td>1,056</td>
<td>1,088</td>
<td>1,120</td>
<td>1,225</td>
<td>1,274</td>
<td>1,325</td>
<td>5.3</td>
</tr>
<tr>
<td>Dye and Pigment</td>
<td>229</td>
<td>235</td>
<td>242</td>
<td>249</td>
<td>256</td>
<td>263</td>
<td>2.8</td>
</tr>
<tr>
<td>Eco-Friendly Coating</td>
<td>231</td>
<td>252</td>
<td>280</td>
<td>312</td>
<td>343</td>
<td>377</td>
<td>10.3</td>
</tr>
<tr>
<td>Ceramic Coating</td>
<td>41</td>
<td>46</td>
<td>52</td>
<td>61</td>
<td>70</td>
<td>79</td>
<td>14.0</td>
</tr>
<tr>
<td>Physical and Chemical Coating</td>
<td>272</td>
<td>282</td>
<td>298</td>
<td>325</td>
<td>344</td>
<td>364</td>
<td>6.0</td>
</tr>
<tr>
<td>Optical, Electronic, and Thermal Coating</td>
<td>126</td>
<td>141</td>
<td>184</td>
<td>202</td>
<td>234</td>
<td>274</td>
<td>16.8</td>
</tr>
</tbody>
</table>


Samhwa Paints Industrial Co., Ltd. develops high-tech functional coatings for woodwork, construction, industrial use, ships, and airplanes as well as rust-resistant coating for key industries such as chemical and power plants, pre-coated metal (PCM) coating for metallic materials of home appliances, plastic coating, natural paint, and water-soluble functional coating products.

KCC Corporation Co., Ltd., NOROO Paint & Coatings Co., Ltd., Construction Chemical Industry Co., Ltd, Samhwa Paint & Coatings Co., Ltd, and Hanjin Chemical Co., Ltd. have recently entered the Middle East, Southeast Asia, and CIS markets based on their improved technologies and market entry experience to Shanghai, China.

**Trends in Technological Development**

The number of patent applications for functional coating materials were either maintained or experienced a slight increase until 2013. Over 60% of annual patent applications are submitted by domestic companies.

Large companies (including Toray Advanced Materials Korea, Dongwoo Fine-Chem, and LG Chem) account for an overwhelming share of patent applications. Among small and medium-sized enterprises, Next Generation Technology and Nano Solution submitted the largest number of applications (five each). Among universities, research institutes, and public offices, Korea Research Institute of Chemical Technology (KRICT) submitted the most with nine patent applications.

**Competitive Advantages**

The specialty chemicals industry is comprised of highly competitive downstream industries, including automotive, shipbuilding, display, and mobile phone. There is strong potential in the convergence with and applications of new technologies including IT, Business Technology (BT), New Technology (NT) and engineering technology. The sector also boasts outstanding process management capability and systems, which meet the explosive demand for highly functional and eco-friendly coating materials.

**Functional Film Materials**

**Current Standing**

Korea’s representative flat panel display (FPD) functional film manufacturers include LG Chem Co., Ltd., SKC Co., Ltd., Hanwha Advanced Materials Co., Ltd, Samsung Electro-Mechanics Co., Ltd, Kolon Co., Ltd, ACE DIGITECH Co., Ltd, Shinwha Co., Ltd, MNtech Co., Ltd. and Nano Chem Tech Co., Ltd. Large companies take up the majority due to the enormous market size and huge initial development costs.

Backed by the policy support of the government to domestically produce diffusion films, SKC Co., Ltd. now holds almost 100% of the market share in the Korean diffusion film industry. SKC operated four PET film factory lines in Nantong, Jiangsu, China from 2012 to 2013.

Kolon Co., Ltd. began the supply of raw films for cell phone touch panels in 2011. It started the operation of new supply lines in the third quarter of 2012.

Production Status and Prospect of Korean Functional Film Materials

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductive Film</td>
<td>930</td>
<td>985</td>
<td>1,043</td>
<td>1,043</td>
<td>1,104</td>
<td>1,169</td>
<td>5.9</td>
</tr>
<tr>
<td>Release Film</td>
<td>183</td>
<td>201</td>
<td>221</td>
<td>221</td>
<td>244</td>
<td>268</td>
<td>10.0</td>
</tr>
<tr>
<td>Window Film</td>
<td>296</td>
<td>400</td>
<td>539</td>
<td>539</td>
<td>728</td>
<td>983</td>
<td>35.0</td>
</tr>
<tr>
<td>Transparent Film</td>
<td>8,346</td>
<td>8,838</td>
<td>9,359</td>
<td>9,359</td>
<td>9,912</td>
<td>10,497</td>
<td>5.9</td>
</tr>
</tbody>
</table>

Source: Small and Medium Business Administration (Jan. 2016)

Trends in Technological Development

The number of patent applications regarding functional film materials continued to increase until 2013. Over 55% of annual patent applications are submitted by domestic companies. Large companies (including LG Chem, Dongwoo Fine-Chem, Cheil Industries, Toray Advanced Materials Korea) account for an overwhelming share of patent applications.

Competitive Advantages

Some of the advantages include world-class production capacity, accumulated film production technologies and sufficient production experience. There are a number of globally competitive companies in a variety of areas including home appliances, semiconductors, display and mobile phones which have the ability to swiftly respond to rapidly changing trends. There is a growing demand for highly functional and eco-friendly coating materials, largely attributable to low-carbon green growth policies.

Functional Textile Materials

Current Standing

As a traditionally strong player in the textile and clothing sector, Korea recently is developing new products through the convergence of technologies regarding wearable smart fibers. About 20 domestic and foreign businesses are currently in the Korean outdoor market. They include 10 domestic businesses (Hyosung Co., Ltd., Kolon Sport Co., Ltd., Paka Co., Ltd. and Shinhan Industrial Co., Ltd.) and seven to eight foreign businesses (Schoeller Korea, INVISTA Korea and Gore Korea).

Taekwang Industrial Co., Ltd. built a carbon fiber factory in Ulsan (March 2012) for the first time in Korea, and its production capacity is 1,500 tons/year. Hyosung Co., Ltd. held the dedication ceremony of its Jeonju factory in May 2013. The factory has a production capacity of 2,000 tons/year. Toray Advanced Materials Korea Co., Ltd. (invested by Toray Group Japan) built its carbon fiber factory 1 in Gumi, Gyeongsangbuk-do (April 2013) to produce 2,200 tons/year and factory 2 (Mar. 2014) to produce 2,500 tons/year.

Adhesive Materials

Current Standing

Korea’s adhesive material industry is comprised of 250 small and medium-sized companies, which shows the industry’s SME-oriented characteristics.

As of 2014, the Korean adhesive material market was estimated to be approximately 600,000 tons, consisting of formaldehyde (33%), solvent (5%), water-soluble adhesive (34%), hot melt (4%), reactive (6%), adhesive (12%), and others (6%).

General adhesive is used for different purposes in a variety of industries, but about 70% of them produced in Korea is used for construction and interior. As such, this segment is highly sensitive to the economic conditions of the construction industry.

8) Refer to CMRI (2015), 8) Korean Adhesive Market Analysis and forecast.)
As of 2014, the adhesive material market can be broken down into acrylic electric and electronic (49.5%), labelling (19%), construction and interior (13%), automotive (13%), silicon electric and electronic (3.5%), and others (2%).

- The large shares of electric and electronic market (53%) indicates that the industry is highly reliant on the adhesive materials for electric and electronic purposes.

Korean businesses are increasing their market shares in the specialty adhesive market—optically clear adhesive (OCA), optically clear resin (OCR), die attach film (DAF), organic light emitting diode (OLED) encapsulant, and automotive structure adhesives—which has been dominated by foreign businesses.

- As Okong, UNITECH, Bokwang, and Shinsung Petrochemical began developing automotive structure adhesive materials, their market share drastically increased in 2015. The market had been previously dominated by Henkel.

The Korean specialty adhesive market is relatively smaller than the general adhesive market. However, Korean firms such as LG Chem, Innox, and KCC Corporation are focusing on the development of special adhesives for their high added value.

However, chances are high that Korean firms will induce investment from multinational corporations for the extensive research and development of high-grade adhesives, which is a key product among specialty adhesives.

**Trends in Technological Development**

The number of patent applications for adhesive materials increased until 2012, but decreased in 2013 with Korean companies accounting for 30-40% of them. Foreign companies took the biggest share of patent applications (60%), followed by large businesses (21%), small and medium-sized businesses (10%), universities/research institutes/public organizations (5%), and individuals (3%). Adhesive technology is popular among overseas applicants or large businesses with strong capitals.

**Competitive Advantages**

There is an enormous demand for the specialty chemicals sector led by Korea’s world-class technological prowess in the electric and electronic industries. The industry also has strong potential in the convergence and applications of cutting-edge technologies as well as well-established infrastructure. Various high-molecule adhesive material markets are continuing to expand.

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**Paint, Dye and Pigment Materials**

**Current Standing**

The Korean paint industry is primarily led by domestic demand. Korea is one of the top 10 global paint producers, with its major five players (KCC Corporation, NOROO Paint & Coatings, Construction Chemical Industry, Samwha Paints Industrial and Chokwang Paint) taking up 80% of the domestic market. Kyung-In Synthetic Corporation and Ohyoung have 70% of the market share in the Korean dye and pigment industry, while RIFA, M. Dohmen Korea, Samwon Industry, Snogen and other small and medium-sized businesses take up the rest. Export is estimated to be 10% of production, because of the high logistics cost to deliver large volumes of liquid paint as well as the high risk of volatility.

However, the actual share of exports is expected to be much higher than the estimate, given that key paint markets such as automotive and shipbuilding industries (excluding the construction industry which has the largest demand for paint) recorded 70% and 95% of export shares ("local export") in 2015, respectively.

The amount of Korea’s paint production reached KRW 6.37 trillion (USD 5.79 billion) in 2014, a 2.6% increase from the previous year. Paint products were used mostly for construction, shipbuilding, automobiles, floor/waterproofing and road signs. During the same period, the production of the dye and pigment industry decreased by 5.8% to KRW 2.44 trillion (USD 2.22 billion). Most of the products were used for textile, print and ink. Meanwhile, paint products are increasingly used for dye-sensitized solar cells and information recording media.

**Production Status and Prospect of Korean Paint and Dye/Pigment Materials**

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paint</strong></td>
<td>Eco-Friendly</td>
<td>694.0</td>
<td>726.6</td>
<td>747.1</td>
<td>806.7</td>
<td>893.7</td>
<td>975.5</td>
<td>9.8</td>
</tr>
<tr>
<td></td>
<td>Ceramic</td>
<td>69.2</td>
<td>71.9</td>
<td>75.1</td>
<td>80.3</td>
<td>88.3</td>
<td>95.8</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>Photoelectric and Thermal</td>
<td>208.2</td>
<td>215.4</td>
<td>239.2</td>
<td>283.6</td>
<td>337.1</td>
<td>388.8</td>
<td>16.3</td>
</tr>
<tr>
<td><strong>Dyes</strong></td>
<td>Physicochemical</td>
<td>695.2</td>
<td>726.6</td>
<td>740.7</td>
<td>783.7</td>
<td>853.8</td>
<td>918.8</td>
<td>8.5</td>
</tr>
<tr>
<td></td>
<td>Textile</td>
<td>159.8</td>
<td>165.9</td>
<td>167.2</td>
<td>174.5</td>
<td>188.8</td>
<td>202.0</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>Printing and Ink</td>
<td>99.9</td>
<td>103.7</td>
<td>104.6</td>
<td>109.1</td>
<td>126.3</td>
<td>142.8</td>
<td>10.2</td>
</tr>
<tr>
<td></td>
<td>Paint</td>
<td>79.9</td>
<td>83.0</td>
<td>83.6</td>
<td>87.3</td>
<td>111.9</td>
<td>136.0</td>
<td>14.1</td>
</tr>
<tr>
<td></td>
<td>Information</td>
<td>59.9</td>
<td>62.2</td>
<td>62.7</td>
<td>65.5</td>
<td>79.2</td>
<td>92.4</td>
<td>11.9</td>
</tr>
</tbody>
</table>

Source: Small and Medium Business Administration (Jan. 2016)
**Trends in Technological Development**

The number of patent applications for paint, dye and pigment continued to increase until 2013, with Korean companies accounting for over 60% of them. Foreign companies took the biggest share of patent applications (36%), followed by small and medium sized businesses (26%), and large companies (19%). Large chemical companies in Korea including Dongwoo Fine-Chem, LG Chem and KCC Corporation are gearing up efforts to apply for paint and dye/pigment patents.

**Competitive Advantages**

The paint and die sector is comprised of massive downstream industries encompassing construction, automotive, shipbuilding, and textile. There is a large and diversified demand for highly functional paint and dye/pigment thanks to the technological advancement in these industries.

The industry boasts technological competitiveness, accumulated experience and knowhow regarding process management, well-established infrastructure including human talent, as well as the government's supportive policies.

**Automotive Engineering Plastic**

**Current standing**

Due to the popularity of lightweight vehicles and reinforced environmental regulations, demand for highly functional engineering plastic (EP) materials and carbon fiber is on the rise in Korea. Korean EP businesses include Cheil Industries, Samyang Corporation, Kolon Plastics, KOPLA, Lotte Chemical, and Hyundai EP.

The Korean Polyphenylene Sulfide (PPS) market is expected to grow by over 10% annually from 4,000 tons (compound) in 2013 to 8,000 tons in 2020. The global PPS market is likely to grow by 9% to 140,000 tons.

**Examples of Automotive EP Applications in Korea**

<table>
<thead>
<tr>
<th>Company</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>SsangYong Motor Company Co., Ltd.</td>
<td>Received the Technical Innovation Award at JEC World Composites Show (the world’s largest of its kind) in March 2016, for its tailgate parts made up of carbon fiber reinforced plastics (CFRP).</td>
</tr>
<tr>
<td>Hyundai MOBIS Co., Ltd.</td>
<td>Reduced 40% of the weight of a head lamp by applying plastic (instead of glass) to its apherical lens.</td>
</tr>
<tr>
<td>Hanwha Chemical Co., Ltd.</td>
<td>Exhibited its plastic automotive fenders and tire bladders at the Korea International Chemical Industry Expo 2015. - Fender: entered the commercialization stage, bladder: in the final development stage (field tests by customer companies).</td>
</tr>
<tr>
<td>Lotte Chemical Co., Ltd.</td>
<td>Showcased its carbon fiber and plastic composite that is 60% less heavy but as strong as steel.</td>
</tr>
<tr>
<td>SK Chemicals Co., Ltd.</td>
<td>Plans to develop the world’s first super EP, chlorine-free polyphenylene sulfide (PPS) and increase its global market share to over 20% by 2020.</td>
</tr>
<tr>
<td>Hanwha Group</td>
<td>Acquired Heycoustics (a german automotive part company whose annual sales revenues are KRW 30 billion) at KRW 15 billion in March 2015, as part of their efforts to enter the automotive plastic market.</td>
</tr>
</tbody>
</table>

SPECIALTY CHEMICALS

INDUSTRY OVERVIEW

Trends in Technological Development
SK Innovation installed two additional manufacturing units to produce ceramic-coated separator (CCS), which has better physical properties than lithium-ion battery separator (LiBS), a key material for rechargeable batteries of electric vehicles. In addition to exiting unit 1, the construction of unit 2 and 3 began in June 2016 and will be completed by the first half of 2017.

In September 2016, the Korean government and industry leaders forged a partnership to develop battery materials and high-performance products.
- The EV-Rechargeable Battery Convergence Alliance was established that convenes 230 Korean experts from a total of 27 companies, universities and research institutes.
- The alliance plans to develop a high-density battery that enables a 400km drive with a single charge.

The Ministry of Trade, Industry and Energy and the private sector will invest KRW 27 billion (USD 22.5 million) and KRW 16 billion (USD 13.3 million) by 2020, respectively (KRW 43 billion or USD 35.8 million in total).

Plasmapp Co., Ltd. is a startup located in Daejeon, established in 2015. It has successfully secured funding through a variety of venture support programs offered by Small and Medium Business Corporation, Korea Institute of Startup & Entrepreneurship Development, and Center for Creative Economy and Innovation.
- The company has key original technologies related to plasma generation and sterilization including linear jet plasma source (LJPS).

Competitive Advantages
Korea is one of the top three major manufacturers of lithium-ion rechargeable battery and separation membrane in the world. It is also leading the mobile phone and electric vehicle industries, which have high demand for rechargeable batteries, and is rapidly catching up with advanced economies in the global new/renewable energy market.

Because the country is located in Asia, which boasts the largest market and highest growth rate in the world, logistics cost can be reduced and local demands can be quickly met. Korea also has excellent infrastructure and superb R&D resources.

Competitiveness of the Industry

National Competitiveness

Hub of East Asian FTAs
The Korean government has actively pushed ahead with free trade agreements (FTA) since 2003 and is building a network by expanding strategic FTAs with large economies, resource-rich countries, and key economic blocs such as EU and NAFTA. Korea aims to establish an extensive FTA that eliminates tariffs not only for goods but also for services, investment, governmental procurement, intellectual property and technical standards.

It also seeks an advanced level of FTA in compliance with the WTO rules regarding products and services, in order to supplement multilateralism and ultimately improve domestic regulatory systems. It is expected that the EU, the US and Japan will turn to Korea instead of China as their production bases and Korea's exports will rise.

As Korea signed an FTA with China in November 2014, Korea will be the gateway to China for advanced companies that had difficulties in direct exports to or investments in China. This FTA significantly lowered tariff barriers, enabling Korea to increase its exports to China which has the biggest import market in the world.

Industrial Competitiveness
Korea offers a variety of incentives for high-tech chemical material businesses in industrialized countries. It is one of the few manufacturing powerhouses in East Asia that has a broad range of downstream industries including automotive, electrics and electronics, construction, textile and plastics.

Korea is the fifth largest automobile manufacturer (4.5 million units in 2015). By company, Hyundai Motor Company is the fifth largest automobile manufacturer (7.5 million units in 2015) in the world. As for electronics, the market share of Samsung and SK hynix is on the rise. In the first half of 2016, their combined market share in the global dynamic random access memory (DRAM) market recorded 72%, making Korea the largest DRAM manufacturing country in the world.

Meanwhile, Samsung SDI and LG Chem produce the largest and second largest volume of compact rechargeable batteries in the world. SK Innovation successfully developed a separator, a key material for rechargeable batteries, for the first time in the country and the third time in the world. The company is currently supplying SOS of the domestic demand for separators.
Value-Added Specialty Chemicals for Electronics

- Semiconductor materials: single crystal silicon wafer, chemical mechanical polishing slurry, epoxy molding compound (EMC), photoreists, and encapsulant
- Display materials: polyvinyl alcohol (PVA) film (for the polarization of the polarizing plate) and triacetyl cellulose (TAC, base film), compensation film, light guiding plate, anisotropic conductive film (ACF), photomask, color filter, photo resist, developer, etchant, and photo spacer
- Rechargeable battery materials: cathode material, anode material, electrolyte, and separator

Source: Naver.

Human Resources

Korean talent are characterized by their high educational performances and passion for learning, as is reflected in the country’s rapid industrialization. Korea is also renowned for on-time delivery, along with their traits such as diligence, faithfulness, and rule observance.

Opinions of Frank Little, CEO of 3M Korea

"Korea is more attractive than China to multinational businesses, as an investment market and a parts and raw materials supplier. Korea boasts highly competitive IT, automotive, shipbuilding and semiconductor industries. Korea is located at the heart of Northeast Asia. Koreans also have many strengths such as strong will, passion, timeliness, work ethics, and an enthusiasm for education."

"3M Korea was established in 1977 and recorded a KRW 1.2 trillion revenue in 2007. As the third largest among our 60 branches worldwide, 3M Korea is subject to focused support for manufacturing equipment and R&D investment. In fact, the headquarters have invested in the regional branch over KRW 110 billion over the past 3 years. It has over 1,400 employees. It opened a new R&D center and added production lines of adhesive, environment protection devices, and films. 3M Korea has increased its investment in Korea, because it believes in the potential of the Korean market. With these efforts, 3M Korea was selected as the most influential foreign company in Korea and the second most desirable workplace for Koreans."


In Korea, around 120 colleges, universities, and graduate schools have chemistry, applied chemistry, or chemical engineering departments, producing over 80,000 bachelor, master’s, and doctoral degrees every year.

- Most of them are leading the development of value-added specialty chemicals at universities, industrial fields, and research institutes.

Korea has a large pool of skilled talents in this field, with over 127,000 people working for about 2,700 chemical businesses.

Korea is one of the few countries that have skilled engineers in process management. For example, it has established a 24-hour operation system for petrochemical plants.

Infrastructure

Korea has a relatively solid R&D foundation for high-tech chemical materials. Korea’s superb R&D centers include Korea Institute of Science and Technology (KIST), Korea Research Institute of Chemical Technology (KRICT), Korea Testing & Research Institute (KTR), Korea Institute of Carbon Convergence Technology (KCTECH), Korea Institute of Materials Science (KIMS), and Fine Chemicals Technology Research Institute in Ulsan Techno Park.

- Many R&D centers of private chemical businesses, including LG Chem, GS Caltex, SK Central Laboratory, Central Laboratory of Hanwha Chemical, Lotte Chemical Laboratory, Central Laboratory of Hankook Tire, Central Laboratory of Samyang, Aekyung General Technology Center, and Central Laboratory of Kumho Petrochemical are located in the Daedeok Research Complex in Daejeon to focus on the development of specialty chemicals.

Some Korean firms have forged a global supply chain with many foreign businesses, positioning the Korean market as an excellent test bed.

- Furthermore, Korea has proper geological conditions to be a local headquarters in the Asia-Pacific region of global chemical businesses by being located between China and Japan.

Automotive and electric/electronic material segments require all-out support throughout the planning and marketing, technological development, design, pilot plant, mass production, raw material procurement, maintenance/repair, and sales process. Korea provides full-fledged support in those areas.
Petrochemical Clusters

Korea has huge petrochemical industrial complexes in three major coastal areas: Ulsan; Yeosu, Jeollanam-do; and Seosan (Daesan), Chungcheongnam-do.

- Korea boasts several advantages as follows; easy access to industrial water, ports that can store large amounts of petroleum, close proximity to Korean major suppliers and global key market (China), and seamless logistics activities.
- Korea has remained the fourth largest petrochemical producer (8.64 million tons in 2015) following the US, China, and Saudi Arabia since 2010.

Fine chemicals Clusters

High-Tech Chemicals Cluster

Capital and Central Areas
- Jangan High-Tech Industrial Complex
- Dangdong Industrial Complex
- Cheonan Industrial Complex
- Daedeok Research and Development Special Zone
- Kyungwon University (Nanoparticles)
- Soonggul University (Molecular Design)
- Korea Research Institute of Chemical Technology (High-Efficiency New Synthetic Material)
- Baemed and Shiea Industrial Complex (Mini Fine-Chemistry Cluster for Small and Medium-Sized Businesses)

Jeolla-do
- Yeosu National Petrochemical Industrial Complex
- Gwangyang Bay Functional Chemicals Cluster
- Chonnam National University (Fine Chemicals Development Support Center)
- Sunchon National University (Eco-Friendly Material Process)

Gyeongsang-do
- Ulsan National Petrochemical Industrial Complex
- Ulsan Technopark
- Fine Chemicals Technology Research Institute
- Korea Research Institute of Chemical Technology
- Ulsan Green Fine Chemical Research Center
- New Chemical Commercialization Center
- Korea Testing & Research Institute
- Bio-Chemical Commercialization Center
- Ulsan College (Identification of Chemicals)
The Korean fine chemical industry is concentrated in the capital area and industrial complexes, which provide easy access to a highly skilled workforce and logistics.

- About 57% of fine chemical clusters are located in Seoul, Gyeonggi-do and Incheon, and 12% are situated in Chungcheong-do.

Fine chemicals clusters by region
- **Capital area:** Kyungwon University (nanoparticles) and Soongsil University (molecular design) are located in the capital area and the Korea Research Institute of Chemical Technology (highly efficient synthetic new materials) in the central region. Small fine chemicals clusters dedicated to SMEs have already been established or are being planned in the Banwol and Sihwa Industrial Complexes in Gyeonggi-do.
- **Gyeongsang-do:** Ulsan Petrochemical Industrial Complex (Fine Chemicals Materials Technology Research Center, Ulsan Fine Chemical Industry Center, Ulsan New Chemical Commercialization Center of the Korea Chemical Research Center, Korea Testing & Research Institute and Biochemical Commercialization Center), Ulsan College (identification of chemicals).
- **Jeolla-do:** The fine chemicals materials cluster to be established in Gwangyang Bay near the Yeosu Petrochemical Industrial Complex, Chonnam National University (Development Center for Fine Chemicals) and Sunchon National University (Environment-friendly Materials Process Technology Innovation)
  - In particular, the Gwangyang Sepung Industrial Complex was joined by the Korea Research Institute of Chemical Technology, the Korea Testing & Research Institute, Jeonnam Technopark and related companies.
  - The Sepung Industrial Complex, which will be developed from 2015 to 2019 with a KRW 150 billion investment, will evaluate the reliability of specialty fine chemicals and serve as a test bed for general-purpose, differentiated and high-end chemicals.

LCD and semiconductor clusters are located close to where demand side industries have production facilities, such as Paju, Icheon and Giheung in Gyeonggi Province, Cheonan and Tangeong in Chungcheongnam-do Province and Gumi in Gyeongsangbuk-do.

Carbon fiber businesses (Toray Advanced Materials Korea, Hyosung, and Taekwang Industrial) have factories in Gumi, Jeonju, and Gunsan.
Government Policies

The 4th Master Plan for Parts & Materials Development

The Korean government recently announced its 4th Master Plan for Parts & Materials Development, which will be implemented for the next 4 years starting 2017.
• The legal basis of the plan is the Article 3 of the Act on Special Measures for the Promotion of Specialized Enterprises, etc. for Materials and Components.

R&D: Development of Top 100 New Material and Part Technologies by 2025

With the participation of 15 parts & materials research institutes and 18 project directors (PDs) from different industries, the Roadmap for the Development of High-Tech New Parts & Materials Technology will be established by 2025. (The top 100 technologies were selected by The Korea Evaluation Institute of Industrial Technology (KEIT) from September to November 2016.)

The top 100 technologies include 50 parts & materials technologies to respond to the Fourth Industrial Revolution, as well as 50 technologies that can support the sophistication of key industries.

<table>
<thead>
<tr>
<th>For the Response to the Fourth Industrial Revolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iot (21): 5G mobile communication modem, micro light source parts for electronic sensor, etc.</td>
</tr>
<tr>
<td>Big Data (3): high-molecular materials for cloud computers, etc.</td>
</tr>
<tr>
<td>AI (3): high-performance navigation instrument for aircraft, collision avoidance system for drones, etc.</td>
</tr>
<tr>
<td>Robot (18): high-strength and formability aluminum, high-efficiency motor parts, etc.</td>
</tr>
<tr>
<td>3D printing (5): bioceramics for implant, etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>For the Sophistication of Key Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>General (14): sensor parts, lithium-ion battery energy identification technology, etc.</td>
</tr>
<tr>
<td>Automotive and ship (14): magnesium board manufacturing technology, eco-friendly ballaster water processing technology, etc.</td>
</tr>
<tr>
<td>Railroad and aircraft (8): power battery pack module, next-generation solid rubber manufacturing technology, etc.</td>
</tr>
<tr>
<td>Semiconductor and display (8): power semiconductor technology, OLED engineering, etc.</td>
</tr>
<tr>
<td>Bio (6): biopharmaceutical base technology, beauty care ceramic materials, etc.</td>
</tr>
</tbody>
</table>

Source: Ministry of Trade, Industry and Energy (Dec. 27, 2016)

The government is currently mobilizing every resource to develop the top 100 technologies. For example, it announced on August 2016 the cross-departmental national strategy project, which focuses on areas like lightweight materials, self-driving cars, and artificial intelligence (AI).

In particular, the Ministry of Trade, Industry and Energy will nurture R&D for parts and materials businesses so that they can be redesigned to induce convergence. The Ministry of Science, ICT and Future Planning will expand basic research for the development of original technologies for future-oriented materials (e.g. materials with innovative physical properties).

Infrastructure: Improved Infrastructure to Efficiently Support the Convergence of Parts and Materials

The current 15 material and reliability centers will be reorganized into five convergence alliances (metal, chemicals, textile, ceramics/electronics, and machinery/automobile) to promote the convergence of parts and materials. “Virtual infrastructure” will also be established. This includes a big data platform to collect and reproduce data related to high-tech parts and materials (by the Ministry of Science, ICT and Future Planning) as well as a virtual engineering platform to reduce the time and cost for commercialization (by the Ministry of Trade, Industry and Energy).

A consultative group on human resource development will be created, and expanded efforts will be made to nurture human resources that have expertise in the development of new, high-tech parts and materials.

Blueprint for Korea’s Transformation Into a Global high-tech, Value-added Material Leader

Fostering a Cutting-edge Fine Chemical Industry by Securing Key Technologies

The government will expand its investments in the R&D sector and encourage the private sector to promote R&D, in order to help the transformation of the chemical industry to be a value-added and highly functional high-tech material industry. The public and private sector will jointly increase investments to improve the R&D share in the chemical sector from the current 2% (against sales revenues) to 5% by 2025.

There will also be greater investments in R&D, especially on the top three key materials technologies: futuristic key industrial materials, value-added fine chemicals, and eco-friendly chemicals. For futuristic key industrial materials, lightweight materials (for electric vehicles, aircraft, and drones), and special materials (for extreme conditions such as high temperature, high pressure and extremely low temperature) will be fostered. In the area of value-added fine chemicals, industrial chemicals that are highly reliant on imports (highly functional dye and pigment) and functional materials commonly used in daily lives (health care) will be the main focus of priority. Finally, the government will work to spur the growth of eco-friendly chemicals, which include eco-friendly nontoxic materials (to respond to the customer needs for better environment and health) and alternative materials (to prevent global warming and ozone layer depletion).

1) Press release of Ministry of Trade, Industry and Energy (Dec. 27, 2016); “Policies for the parts & materials industry will be transformed to support their response to the Fourth Industrial Revolution throughout the entire business life cycle.”

12) Press release of the Ministry of Trade, Industry and Energy (Sept. 30, 2016); “Development of Large Clusters” from “Backgrounds for the Improved Competitiveness of Steel and Petrochemical Industries.”
To assist in the development of large-scale technologies, tax benefits and industrialization support will be provided. Highly functional fiber, hyper plastics, and other value-added convergence materials are now subject to tax benefits in accordance with the Article 10 (Tax Deduction for Research and Human Resources Development Expenses) of the Restriction of Special Taxation Act (RSTA). Furthermore, New Industry Development Fund (KR₩300 billion) will be offered for R&D investment in association with industry reshuffling. Functional materials and value-added products (e.g. agricultural chemistry and cosmetics) will be added to the “target industries for extensive support” in order to facilitate support from Korea Technology Finance Corporation.

Creating Large-scale Clusters
A master plan was set up in the first half of 2017 to form a specialized industrial complex in Daesan, Seosan-si, Chungcheongnam-do where large companies have relocated into the existing general industrial complex. Four sections of Daesan will be designated as the industrial complex and developed with Daesan Industrial Complex 2.

The government will also help companies relocate to the Science Business Belt Key Zone (Special R&D Zone) around Daedeok Research Complex in Daejeon. Renowned overseas research institutes will be invited, while Korean institutes will be nurtured to become key research organizations in Asia.

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Incentives

R&D Policy

Attracting R&D centers
- Setting up criteria for support: The criteria will be basically similar to the conditions for individual foreign investment zone designation, but will be designed to attract highly skilled engineers.
- Tax deduction, site support, reinforced industrial–academic–research cooperation, participation in government-funded research, campaigns to attract investment, global joint R&D projects, etc.
- The period of reduction and exemption of income tax for foreign engineers working for foreign-invested R&D centers extended to 2018.
- Such tax benefit (50% for the first 2 years) was supposed to be terminated in the end of 2014, but extended to attract more outstanding foreign engineers.
- Support for R&D centers has been limited, since site support has been provided primarily for factories. However, the target has recently been changed to include building rent in addition to factories.

Relevant Laws

- Foreign Investment Promotion Act
- Industrial Development Act (Enacted in February 1999; Amended on January 21, 2014)
- Act on Special Measures for the Promotion of Specialized Enterprises, etc. for Materials and Components (Enacted in February 2001; Amended in November 2011)
- Act on the Special Measures to Revitalize Enterprises (Enacted in February 2016)
- Chemicals Control Act (CCA; Enacted in January 2015)
- Act on Registration, Evaluation, etc. of Chemicals (ACRE; Enacted in January 2015)
- Act on the Allocation and Trading of Greenhouse-gas Emission Permits (AATGGE; Enacted in March 2013)
SUCCESS CASES OF FOREIGN INVESTMENT

FDI Trends in Specialty Chemicals

The Korean manufacturing industry, especially the information electronics segment, has continued on a fast growth path, significantly enhancing its global competitiveness.

• As such, leading Korean companies such as Samsung and LG have growing demand for specialty chemicals with high added value.

Leading Japanese companies are in desperate need of market expansion due to a sharp decline in their competitiveness in the electronics market, such as semiconductor and display parts and set-products.

• More efforts should be made to attract Japanese investment in Korea's parts and materials segment.

• It is encouraging that Korea's electronics parts and materials segments have aggressively sought investments from Japanese companies with successful results.

Japan's medium-sized parts and materials companies rushed to make investments in Korea in 2011 and 2012 to mitigate the risks of natural disasters and minimize damage from power shortages in the wake of the Japanese earthquake in March of 2011.

• In addition, Japan's medium-sized parts and materials companies invested in Korea in order to take advantage of Korea's geographical proximity and the fact that Korea is home to major customer companies.

• In addition, Japanese companies' localization process is smooth in Korea due to cultural similarities and Korea's FTAs with the United States, the EU and India, which remove tariff barriers to these markets.

• Major Japanese investors in Korea include Sumitomo Chemical, Teijin, JX Nippon Oil & Energy and Ibiden Graphite Korea.

European and American chemical businesses that operate in Korea include DuPont, Rohm and Haas, BASF, Dow Chemical (Giheung, OLED Research Center), Solvay (R&D Center, Ewha Womans University), and Merck.

• Investment type: green field, sales office, R&D center, etc.

Proactive efforts are required to induce investments from European and American specialty chemicals businesses in addition to the Japanese ones.

• Gumi has several European and American chemical businesses that have original technologies. As such, Korean petrochemical, electronics, and automotive businesses equipped with capitals can consider direct M&A with them.
Solvay (Sep. 2014 investment)

- Solvay opened the Ewha-Solvay Research & Innovation (R&I) center at Ewha Womans University.
- The 6,600 square-meter center is Solvay’s first research center in Korea and the fourth in Asia. The R&I center will house research labs for the development of OLED display technologies, on which Solvay has placed an extra focus.
- In addition, the R&I center will conduct research on lithium-ion battery materials, OLED materials and high-tech automotive materials. Solvay and Ewha Womans University have already implemented joint research projects such as the development of next-generation metal-air batteries.
- Solvay’s Specialty Chemicals business, relocated to the R&I center, will be responsible for the management and sales of specialty chemicals products produced by Solvay in four continents and serves as a regional center in Asia.
- Solvay has decided to invest KRW 120 billion in the capital area to establish production facilities measuring 99,000 m² by 2017, which will produce ESS, PV, electronic and display materials.
- Solvay is a global chemical business established in 1863. It celebrated its 150th anniversary in 2013. Its head office is in Brussels, Belgium.
- Solvay entered the petrochemical market in the 1960s. It has business operations, production facilities and R&D centers in 50 countries. Solvay is a global enterprise with 400 overseas subsidiaries.
- Solvay posted USD 12.258 billion in sales in 2015, ranking 23rd among the global top chemical companies.
- Solvay operates the chemicals and plastic businesses, making active investments in fuel cells, rechargeable batteries, new and renewable energy, water treatment, organic electronic materials and LED.
- Asia is Solvay’s second-largest market, with a total sales portion of 31%, following Europe (33%).


- It is a Korean subsidiary of the Japanese company Sumitomo Chemical Co., Ltd. It established Iksan Technology Laboratory and a hydrogen peroxide plant in the Iksan factory in December 1993.
- Completed R&D on the decomposition of hydrogen peroxide in July 1994 and successfully launched high-purity hydrogen peroxide for 16 MB DRAM in the next three months.
- Installed additional hydrogen peroxide plants in August 1995 for mass production.
- Expanded and completed sulfuric acid, ammonia liquor, and PA plants from 1995 to 1997.
- Started to build a factory in Pyeongtaek, Gyeonggi-do in June 2000 and established Pyeongtaek Central Laboratory in May 2001.
- Extended its business realm to include polaroid film for thin film transistor-liquid crystal display (TFT-LCD).
- Established Dongwoo ST Co., Ltd. to produce color filter (April 2002) and Dongwoo Optical Film Co., Ltd. to produce polaroid film (October 2002).
- Dongwoo Optical Film Co., Ltd. was renamed to Dongwoo Optical Materials Co., Ltd. in October 2004 and then merged with Dongwoo Fine-Chem Co., Ltd. in October 2005. Dongwoo STI Co., Ltd. was also merged with Dongwoo Fine-Chem Co., Ltd. two months later.
- It built a factory in Palbong, Iksan in April 2006 and established an optical material laboratory in January 2007.
- Pyeongtaek factory became poised for mass production, as the factory 1 was built in April 2003, factory 2 in July 2005, factory 3 in August 2006, factory 4 in April 2007, and factory 5 in May 2008.
- Develops, manufactures, and sells chemicals for semiconductors as well as LCDs, polaroid films, color filters, touch sensor panels, and high-purity alumina.
- Operates three laboratories: an electronic material laboratory (to develop key materials for semiconductors and displays), an optical material laboratory (to develop LCD-material technologies and original technologies of next-generation display materials), and an ADS laboratory established in 2013 (to develop materials and prior technologies for next-generation displays).
- Manufactures products at Iksan, Palbong, and Samgi factories as well as the Pyeongtaek factory where the headquarters is located.
- Relocated its headquarters in January 2013 from Samseong-dong, Gangnam-gu, Seoul to Pyeongtaek, to pursue field-based business management.
- Dongwoo Fine-Chem Co., Ltd. recorded KRW 1.12 trillion in 2005 and became the first company in Gyeonggi-do province that surpassed the KRW 1 trillion mark in sales revenue.
- As of 2015, the company’s sales revenue was KRW 2.15 trillion, which was the fourth largest among foreign-invested businesses in Korea. Its total assets and total capital amount to KRW 1.92 trillion and KRW 1.54 trillion, respectively.

Source: EBN Chemical News and New Daily Economy.

Toray Advanced Materials Korea Co., Ltd. (1999 and 2010)

- Established in 1972, Cheil Synthetic Textile Co., Ltd. was separated from Samsung Group in 1997 and renamed to Saehan Co., Ltd.
- Part of Saehan Co., Ltd. was integrated to Toray Saehan Co., Ltd. as a joint-venture company of Saehan and Toray Japan in 1999.
- Toray Advanced Materials Korea Co., Ltd. has grown into a large joint-venture company with its revenue of KRW 2.1 trillion (based on consolidated financial statement) and 2,383 employees as of 2015.
- Boasts remarkable performances: No. 1 in carbon fiber (Japanese headquarters: No. 1 in the world), PET film, and PPS resin fields in the Korean market and No. 4 in spunbond felt field in the global market.
- Developed many materials for IT devices for the first time in Korea; Japanese headquarters has a 40-year experience in the production and development of polyester textile.
- In particular, the PPS resin (a type of super engineering plastic) is light and has excellent thermal and chemical resistance, mechanical strength, and fire retardant enough to replace metals, making it applicable to automotive, electric, and electronic parts.
- Completed construction and started operation of PPS factory with the capacity of 8,600 tons and 3,000 tons for soft resin and compound respectively in Saemangeum Industrial Complex, Gunsan, Jeollabuk-do in July 2016.
- Expanding its business realms to include eco-friendly materials encompassing life materials, water treatment, and new and renewable energy in addition to the traditional fields such as composites (carbon fiber, etc.), PET film, IT materials, resin compound, PPS resin, biodegradable resin, yarn, and felt.
RELATED COMPANIES AND ASSOCIATIONS

**Related Associations**

<table>
<thead>
<tr>
<th>Name</th>
<th>Website</th>
<th>Address</th>
</tr>
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<tbody>
<tr>
<td>Korea Specialty Chemical Industry Association (KSCIA)</td>
<td><a href="http://www.kscia.or.kr">www.kscia.or.kr</a></td>
<td>29, Digital-ro 32-gil, Guro-gu, Seoul (Guro-dong)</td>
</tr>
<tr>
<td>Korea Petrochemical Industry Association (KPIA)</td>
<td><a href="http://www.kpia.or.kr">www.kpia.or.kr</a></td>
<td>No.601, Yeoeondo Hall, 190, Yulgok-ro, Jongno-gu, Seoul</td>
</tr>
<tr>
<td>Korea Chemical Industry Council (KOCIC)</td>
<td><a href="http://www.kocic.or.kr">www.kocic.or.kr</a></td>
<td>Yeoeondo Hall 6th Fl., 190, Yulgok-ro, Jongno-gu, Seoul</td>
</tr>
</tbody>
</table>

**Petrochemical and Fine Chemical Businesses (as of 2016)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Website</th>
<th>Business Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>LG Chem</td>
<td><a href="http://www.lgchem.com/kr/main">www.lgchem.com/kr/main</a></td>
<td>Petrochemistry, construction materials, and electronic materials and parts (polaroid film, rechargeable battery, etc.)</td>
</tr>
<tr>
<td>Dongwoo Fine-Chem</td>
<td><a href="http://www.dwchem.co.kr">www.dwchem.co.kr</a></td>
<td>Semiconductor and LCD materials</td>
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<tr>
<td>Samsung SDI</td>
<td><a href="http://www.samsungsdi.co.kr/gateway">www.samsungsdi.co.kr/gateway</a></td>
<td>Rechargeable battery, semiconductor, and LCD materials</td>
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<tr>
<td>KCC Corporation</td>
<td><a href="http://www.kccworld.co.kr">www.kccworld.co.kr</a></td>
<td>General construction and industrial materials, paints, silicon, etc.</td>
</tr>
<tr>
<td>Nano Chem Tech</td>
<td><a href="http://www.nanosbiz.com/bowi">www.nanosbiz.com/bowi</a></td>
<td>Conductive high molecule, CNT, transparent electrode film, electrolyte, diffusion materials, etc.</td>
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<tr>
<td>SK Chemicals</td>
<td><a href="http://www.clchemicals.com/kr">www.clchemicals.com/kr</a></td>
<td>Transparent thermal copolyester, PLA, PPS, carbon materials, and energy storage materials</td>
</tr>
<tr>
<td>Okong</td>
<td><a href="http://www.okong.com">www.okong.com</a></td>
<td>Water-based, oil-based, and hot melt adhesives</td>
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<tr>
<td>KISCO</td>
<td><a href="http://www.kyungin.co.kr/korea/08home2-1.php">www.kyungin.co.kr/korea/08home2-1.php</a></td>
<td>Fluorescent dyes and intermediate products of dye for textile, paper, and fur detergents</td>
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<tr>
<td>Ohyoung</td>
<td><a href="http://www.ohyoung.net">www.ohyoung.net</a></td>
<td>Synthetic dyes for textile</td>
</tr>
<tr>
<td>CS Tech Co.</td>
<td><a href="http://www.cspore.com">www.cspore.com</a></td>
<td>Rechargeable battery separator</td>
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<tr>
<td>Posco Chemtech</td>
<td><a href="http://www.poscochemtech.com/kr/main.do">www.poscochemtech.com/kr/main.do</a></td>
<td>Cathode and carbon materials for rechargeable batteries</td>
</tr>
<tr>
<td>Hyosung</td>
<td><a href="http://www.hyosung.co.kr/kr/index.do">www.hyosung.co.kr/kr/index.do</a></td>
<td>TAC film for LCD, nitrogen triflouride, carbon fiber reinforced plastics, special industrial gases, etc.</td>
</tr>
<tr>
<td>Kolon Industries</td>
<td><a href="http://www.kolonindustries.com">www.kolonindustries.com</a></td>
<td>Industrial, film, and electronic materials</td>
</tr>
</tbody>
</table>

Source: companies’ website
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