## Major Investments in Growth

### Aggressively Investing in Areas Indispensable for Lifestyle and Social Developments in an Attempt to Further Expand Business

The Group is attempting to further expand business through aggressive investments seizing opportunities in areas indispensable for lifestyle and social developments where demand and business growth are expected in the future.

Shintech (U.S.) is moving forward with the construction of an ethylene production plant, one of the main raw materials used in PVC. This is the first ethylene plant built in the United States by a Japanese chemical company. The plant, currently under construction at Shintech’s industrial site in Louisiana, will produce 500,000 tons of ethylene annually. This approximately US$1.4 billion investment is scheduled for completion in the first half of 2018. With the completion of this ethylene plant, we will expand the integrated production system from PVC raw materials, firmly establishing our position as the world’s largest polyvinyl chloride manufacturer.

In the Silicones Business, we have more than a 50% market share in Japan. We expect global demand for high-performance silicone products to increase. Accordingly, we are investing nearly ¥20.0 billion in Gunma, Niigata and other areas of Japan to upgrade equipment used in each stage of mass production, from R&D to prototyping.

Furthermore, with respect to photoresists, an indispensable photosensitive resin used in the manufacture of semiconductor devices, increased production of semiconductor devices and advances in miniaturization are driving increased demand. Aiming to expand the photoresist business, Shin-Etsu Chemical is investing approximately ¥13.0 billion in the construction of a new plant in Taiwan, one area where demand is growing. In conjunction with the existing Naoetsu plant, this will enable the dispersion of risk across two manufacturing bases.

### Major Investments Completed This Year or Still Ongoing

<table>
<thead>
<tr>
<th>PVC/Chlor-Alkali Business</th>
<th>US$500 million</th>
<th>US$1.4 billion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enabling PVC and Raw Materials Plant Production Capacity</strong></td>
<td>End of 2015: PVC plant completed</td>
<td>Mid-2018: Scheduled for completion</td>
</tr>
<tr>
<td></td>
<td>March 2016: Vinyl Chloride Monomer (VCM) plant partially completed</td>
<td>Annual ethylene production capacity will be 500,000 tons</td>
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<td></td>
<td>Autumn 2017: VCM plant scheduled for completion</td>
<td>This investment will further strengthen the raw materials–based integrated production system being developed</td>
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<tr>
<td></td>
<td>Annual production capacity of VCM increased by 300,000 tons, caustic soda increased by 200,000 tons and PVC increased by 300,000 tons</td>
<td></td>
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<tr>
<td></td>
<td>After facility expansions are complete, the Louisiana plant and the existing Texas plant’s combined annual PVC production will increase to 2.95 million tons</td>
<td></td>
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</tbody>
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Shintech (U.S) Plaquemine plant
In addition, we established a joint venture company in China with the largest fiber optical product manufacturer in China. With an investment totaling nearly ¥12.5 billion, we will construct a fiber optical preform plant.

<table>
<thead>
<tr>
<th>Silicones Business</th>
<th>Silicone-Electronics Materials Research Center</th>
<th>Investment amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan (Gunma Prefecture)</td>
<td>As the core of Shin-Etsu Chemical’s Silicones Business, this R&amp;D center works with technical service bases in Asia, the United States and Europe to strengthen the development of products meeting customer demands.</td>
<td>¥5.0 billion</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Silicones Business</th>
<th>Production Capacity of Silicone High-Performance Products</th>
<th>Investment amount</th>
</tr>
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<tbody>
<tr>
<td>Japan (Gunma and Niigata prefectures)</td>
<td>Expanding facilities at all levels, from R&amp;D and prototyping to mass production to meet rising global demand for high-performance silicone products.</td>
<td>¥20.0 billion</td>
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<tr>
<th>Silicones Business</th>
<th>Production Capacity of Silicone Capacity</th>
<th>Investment amount</th>
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<tr>
<td>Thailand (Rayong Province)</td>
<td>We are increasing silicone monomer production capacity by 50% in Thailand, from 70,000 tons to 105,000 tons annually. At the same time, we are increasing silicone polymer production capacity by 40% in Thailand, from 54,000 tons to 74,000 tons annually.</td>
<td>¥20.0 billion</td>
</tr>
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<table>
<thead>
<tr>
<th>Specialty Chemicals Business</th>
<th>Construction of a New Cellulose Plant</th>
<th>Investment amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States (Louisiana)</td>
<td>SE Tylose expanded hydroxyethyl cellulose (HEC) production capacity by 50%, from 18,000 tons to 27,000 tons annually.</td>
<td>US$120 million</td>
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<tr>
<th>Electronics and Functional Materials Business</th>
<th>Construction of a New Rare Earth Magnet Plant</th>
<th>Investment amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vietnam (Haiphong)</td>
<td>This investment will increase rare earth magnet sintering process annual production capacity by 50%, or 2,000 tons. This will enable us to meet an expected rise in demand mainly in automotive applications and utilize multiple production bases, which will contribute to stable supplies.</td>
<td>¥12.0 billion</td>
</tr>
</tbody>
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<table>
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<tr>
<th>Electronics and Functional Materials Business</th>
<th>Construction of a New Photoresist-Related Products Plant</th>
<th>Investment amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taiwan</td>
<td>Second half of 2017: In addition to meeting rising demand for photoresists due to increased semiconductor device production and advances in miniaturization, the establishment of multiple production bases will contribute to stable supplies.</td>
<td>¥13.0 billion</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Electronics and Functional Materials Business</th>
<th>Construction of a New Fiber Optical Preform Plant</th>
<th>Investment amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>China (Hupei Province)</td>
<td>Scheduled for completion</td>
<td>¥12.5 billion</td>
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<tr>
<th>Electronics and Functional Materials Business</th>
<th>Construction of a New Photomask Blanks Plant</th>
<th>Investment amount</th>
</tr>
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<tbody>
<tr>
<td>Japan (Fuku Prefecture)</td>
<td>Scheduled for completion</td>
<td>¥7.0 billion</td>
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</table>

Shin-Etsu Chemical is investing in areas driving increased demand. Aiming to expand the photoresist business, Shin-Etsu Chemical is investing in Silicone-Electronics Materials to upgrade equipment used in each stage of mass production, from R&D to prototyping. This will enable us to meet an expected rise in demand mainly in automotive applications and utilize multiple production bases, which will contribute to stable supplies.
The Shin-Etsu Group has engaged in rationalization efforts to stably provide customers with high-quality products and realize high profitability.

As the promotion of rationalization contributes to the creation of a strong corporate structure during economic downturns, former president Kanagawa established and activated the “G Committee” in 1992 based on his concept and determination after the collapse of the bubble economy. The object of the G Committee activities is to lower expenses and reduce costs by improving manufacturing technologies at Shin-Etsu Chemical’s four plants. Former vice president Koyanagi was the first chairman of this committee.

Based on our engineers’ understanding of the essence of technology, the G Committee engaged in the promotion of laborsaving, automation and facility renovations. While promoting cost reductions through rationalization, we also rapidly implemented thorough repairs to ensure safety.

Initially, some had the mistaken impression that rationalization would cause workplace morale to decline, but once the engineers understood that the committee’s proposals would contribute to earnings as specific rationalization costs, there was a complete turnaround and these activities provided motivation to engineers, who ambitiously engaged in rationalization.

These initiatives had a major effect in a variety of ways. Successful rationalization efforts at one plant were deployed at other plants, promoting the exchange of technologies between plants. Rationalization ideas were shared among plants, giving rise to a competitive atmosphere, the effects of which cannot be calculated in monetary terms.

Since being appointed as chairman in 2004, I have extended the G Committee activities conducted until now at Shin-Etsu Chemical’s four plants to manufacturing subsidiaries across Japan.

The first step was to raise engineers’ awareness. There are a variety of factors with unspecified causes that have both positive and negative impacts on current processes, thus there was resistance to the risks accompanying changes to these processes. I regularly visit each plant to provide guidance directly to young engineers, which I consider part of my role as committee chairman. Rather than simply maintaining the status quo, I want to emphasize that engineers should not accept that the current processes are the best. The mission of every Shin-Etsu Chemical engineer is to improve current processes, reduce costs, increase quality and reap the rewards of enhanced productivity. At present, engineers continue to be engaged in rationalization, verifying risks related to process changes from the collection and analysis of data.

In this way, the G Committee will go beyond cost reductions and engage in a variety of activities aimed at strengthening our corporate structure and achieving waste elimination, energy conservation, quality consistency and engineering developments. These long-term efforts have led to manufacturing technology reforms that contribute to strengthening the competitiveness of the Shin-Etsu Group.
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**Environmental Control and Safety Audits (Kashima Plant, Ibaraki, Japan)**

Auditors from the Headquarters Environment Control and Safety Department and each plant monitor Shin-Etsu Chemical’s four plants and two domestic Group company plants. They conduct reports on the implementation status of environmental and safety management plans and conduct onsite inspections to confirm equipment safety measures.
Research and Development Meeting Social Demands

Aiming for Sustainable Growth and the Resolution of Social Issues through Research and Development

Toshinobu Ishihara
Senior Managing Director
In charge of New Functional Materials and Patents, General Manager, Research & Development Department

The Group engages in R&D activities focused on a variety of themes based on our Corporate Mission Statement: “The Group strictly complies with all laws and regulations, conducts fair business practices and contributes to people’s daily lives as well as to the advancement of industry and society by providing key materials and technologies.” We view R&D capabilities as an important “asset” that will ensure the future of the Group and society. Research themes are carefully selected primarily on the basis of whether they meet next-generation needs and for their distinction in terms of not being researched by other companies. Thus, we have successfully achieved the development of many “world’s first” materials. In recent years, social demands have called for automobiles that are safer, more fuel efficient and with lower emissions. Using materials for automobiles as an example, I would like to introduce Group technological development initiatives focused on magnets that will contribute to the resolution of social issues.

The Group’s magnet technologies contribute to the improved performance of the motors used in hybrid electric vehicles (HEVs), plug-in hybrid vehicles (PHVs), fuel cell vehicles (FCVs) and electric vehicles (EVs). In particular, the rare earth magnet technologies (grain boundary diffusion method) developed by the Group ahead of other companies offering high heat resistance and high magnetic field strength are used in the motors of the aforementioned vehicles, improving performance and contributing to the resolution of the following social issues.

Contributing to the Realization of Weight Reduction and Fuel-Efficient Vehicles

The spread of HEVs, PHVs, FCVs and EVs encourages the reduction of fuel usage or the promotion of fuel efficiency. Furthermore, the Group’s silicone technologies contribute to lighter weight vehicles as high weather resistant silicone parts able to withstand harsh conditions can be used to replace conventional metal parts.

Contributing to the Realization of Low and No Emission Vehicles

Encouraging the spread of HEVs, PHVs, FCVs and EVs also contributes to lowering or eliminating vehicle emissions. The Group’s onboard lithium-ion battery anode technology also contributes to the spread of EVs and PHVs.

Contributing to the Realization of High Safety

Advances in vehicle driving electronic controls are increasing safety by providing emergency assistance to drivers who are slow to react or make errors of judgment.
Research and Development Meeting
Social Demands
Management Report
Management Topics

magnets that will contribute to the resolution of social issues. For example, I would like to introduce Group technological development initiatives focused on safer, more fuel efficient and with lower emissions. Using materials for automobiles as an example, the Group has developed lighter weight vehicles as high weather resistant silicone parts able to withstand harsh conditions. This demonstrates how materials can be used to replace conventional metal parts.

In the automobile field, the Group contributes to the spread of HEVs, PHVs, FCVs and EVs. This encourages the reduction of fuel usage or the promotion of fuel efficiency. Furthermore, the Group also contributes to the spread of HEVs and PHVs. The Group’s research activities are driven by society’s demands for automobiles that are safer, more fuel efficient and have lower emissions. Thus, we have successfully achieved the development of many technologies (grain boundary diffusion method) developed by the Group ahead of other companies. Therefore, society views R&D capabilities as an important asset.

The Group engages in R&D activities focused on a variety of themes based on our corporate mission statement. The Group strictly complies with all laws and regulations, conducts fair business practices and contributes to people’s daily lives as well as to the advancement of industry and society by providing key materials and technologies. The Group’s protection capabilities of intellectual property through patent applications have a strong reputation.

Thomson Reuters “Top 100 Global Innovator 2015” worldwide intellectual property award ceremony. Jun Watanabe, General Manager of the Patent Department (right), receives the award from Yoshiko Tanahashi, Director, Thomson Reuters Japan (left). The Shin-Etsu Group’s protection capabilities of intellectual property through patent applications have a strong reputation. This is the fifth year in a row we have received this award.

Shin-Etsu Chemical Group products used in the fourth-generation Prius

Engine/Drive Systems
Silicones
- Insulation, encapsulation and heat dissipation materials for PCU devices used in HEVs and FCVs
- Hoses and other molded rubber products
Rare earth magnets
- HEV and EV drive motors and generators
Cellulose
- Additive to ceramic molding products for exhaust gas purification

Electrical Systems
PVC
- Wire harness coverings
Silicones
- Adhesives, seals, encapsulation, protection materials for electric/electronic parts

Rare earth magnets
- Electric power steering
- Electric car air conditioners
- Electromagnetic clutches
Organic electronics materials
- Encapsulation materials for various sensors

Input devices
- Power windows
- Audio switches

Underbody
Silicones
- Brake part lubricants
Rare earth magnets
- Motors for AWS system
- Electro-hydraulic brake boosters

Other
PVC
- Console boxes, rear partitions, interior and exterior parts
Semiconductor silicon
- IC substrate materials for electrical products
Silicones
- Automotive paints, airbag fabric coatings, etc.

Rare earth magnets
- Hard disk drives for car navigation, etc.
Organic electronics materials
- Sealant for LED headlamps, etc.
Liquid fluoroelastomers
- O-rings for fuel systems and other molded rubber products
Cellulose
- Molding builder for battery parts

Patents by Region
- Patents Acquired
  (in the fiscal year ended March 31, 2016)
Japan 616
North America 282
Asia/Oceania 602
Europe 270
Other 9
Total 1,779

- Patents Held
  (Cumulative as of March 31, 2016)
Japan 7,027
North America 2,850
Asia/Oceania 4,190
Europe 3,035
Other 27
Total 17,129

R&D Expenses
(Y billion)

<table>
<thead>
<tr>
<th>Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>35.7</td>
<td>37.7</td>
<td>43.5</td>
<td>47.1</td>
<td>53.1</td>
</tr>
</tbody>
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