



TOSOH

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# ANNUAL REPORT

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Tosoh Corporation and consolidated subsidiaries  
Fiscal year ended March 31, 2016

**TOSOH CORPORATION**

**Forward-Looking Statements:** Annual reports contain estimates, projections, and other forward-looking statements, which are subject to unforeseeable risks and uncertainties. Readers should understand that Tosoh's business and financial results could differ significantly from management's estimates and projections.

For reference purposes only, US dollar amounts have been translated, unless otherwise indicated, from yen at the rate of ¥112.68 = US\$1, the prevailing exchange rate at the end of the fiscal year under review.

Tosoh Corporation's 2016 fiscal year covers the period from April 1, 2015, to March 31, 2016.

## REVIEW OF OPERATIONS

### SPECIALTY GROUP

#### Snapshot

The Specialty Group meets the needs of its varied customers for high-value-added bioscience, organic chemicals, and advanced material products and technologies. Its extensive offerings are solidly positioned in stable and expanding niche markets and drive Tosoh's profitability.

The Specialty Group's clients span the globe and include companies in the pharmaceutical, health care, semiconductor, consumer electronics, and automobile industries. Among them are emerging businesses whose successes hinge on the Specialty Group's development of solutions to fuel their progress. Innovative products and technologies from the Specialty Group align Tosoh with market opportunities and offer potential for sustainable expansion strategies.

#### Group Performance and Markets

##### *Results Overview*

In fiscal 2016, Specialty Group net sales decreased 0.2% from a year earlier, to ¥174.5 billion (US\$1.5 billion). That constituted 23.2% of Tosoh's consolidated net sales, up from 21.6% in fiscal 2015. Group operating income climbed 9.1%, to ¥32.7 billion (US\$290.2 million), and accounted for 47.1% of Tosoh's consolidated operating income, compared with 58.3% a year earlier. The group's operating margin was 18.7%, an increase from 17.1% in fiscal 2015.

Shipments of ethyleneamines by the Specialty Group decreased in fiscal 2016 as Tosoh's competitors expanded their ethyleneamine production capacity, exacerbating an imbalance in favor of supply over demand. Overseas, the group also faced increased prices for its ethyleneamine products because of a weak yen.

Among the group's separation-related products, shipments of liquid chromatography packing materials rose. The group's diagnostic-related products experienced a similar increase in shipments of in vitro diagnostic reagents. Its shipments of high-silica zeolites (HSZ) likewise increased, thanks to a boost in production capacity in fall 2014, as did its shipments of zirconia for dental applications.

#### Developments

##### *Capital Investments*

During the year under review, Tosoh began increasing zirconia powder production capacity at its Nanyo and Yokkaichi Complexes in response to growing global demand, particularly for dental and fashion parts applications. Construction to expand capacity for producing zirconia

powder at the Nanyo Complex, in Shunan City, Yamaguchi Prefecture, commenced in June 2015 and was completed in November 2015. At the Yokkaichi Complex, in Yokkaichi City, Mie Prefecture, the construction of zirconia production facilities began in February 2016 and is slated for completion in October 2016. These expansions should boost Tosoh's zirconia production capacity around 30% at an investment cost of about ¥3.9 billion.

In the meantime, the Specialty Group launched the commercial production of zirconia powder at the Nanyo Complex's new facilities in March 2016. It is scheduled to do so in April 2017 at the Yokkaichi Complex.

Elsewhere, work is progressing with the construction of a reaction tower for the Specialty Group's bromine operations. When completed in fiscal 2018, the state-of-the-art tower will lower production costs and raise competitiveness for Tosoh's bromine business.

##### *Network Expansion*

In fiscal year 2015, the Specialty Group's Bioscience Division set up Tosoh Europe International N.V., in Belgium. It then opened a branch office of this new company in Dubai, in the United Arab Emirates, to better serve customers in the Middle East and Africa.

Early in fiscal 2016, Tosoh expanded and strengthened its bioscience operations by acquiring Indian in vitro diagnostics company Lilac Medicare Pvt. Ltd. Lilac's products have become well known throughout India since that company's establishment in 1997. And Tosoh is drawing on the renamed Tosoh India Pvt. Ltd.'s domestic network and product familiarity to boost its share of the growing Indian market. Specifically, Tosoh is using the Specialty Group's immunological and diabetes diagnostic analyzers as stepping-stones toward establishing a firm position in India for its bioscience business.

#### Strategies and Outlook

##### *Organic Chemicals*

The Specialty Group has three strategic objectives for its organic chemicals business segment. The first is to boost profitability by reinforcing the production structure and by enhancing cost-competitiveness in ethyleneamines, bromines, and flame retardants. The second is to create new business by capitalizing on growing demand for more environmentally friendly polyurethane amine catalysts, heavy metals treatment agents, and industrial cleaners. The third is to build a superior technological position as a supplier of organic electroluminescent materials.

Tosoh is one of the world's largest producers of ethyleneamines, and it exports around 80% of its 71,000-metric-ton annual ethyleneamine output. To reinforce its competitive position, in fiscal 2017 and beyond the company will review its manufacturing processes and setup for ways to increase its production of high molecular weight amines. That increase will contribute

to a more stable supply of higher amines in the absence of global production capacity increases by competitors who use the same ethylene dichloride production process to make ethyleneamines as Tosoh. At the same time, Tosoh will prioritize lowering its ethyleneamine-related logistics costs and inventories.

The Specialty Group, therefore, will continue its shift to high molecular weight amines while enlarging its ethyleneamine derivative network globally. As part of that drive, it will act on proposals for systems to better produce the isocyanates and polyols for its RZETA<sup>®</sup> polyurethane catalyst operations that are so key to the automotive and furniture industries. It will also bolster the formulation capacity of its Toyocat facilities.

To ensure long-term growth for its eco-business products and services, the Specialty Group has a twofold business strategy. It will reinforce its competitiveness in top-of-the-line brands for the environmental and recycling market by continuing to make the piperazine-based agents that are its core environmental product line. It will also look beyond its domestic market to the emerging markets of China and other Asian countries, where rapid economic development poses pressing environmental issues.

#### *Advanced Materials*

##### *Zeolites*

Tosoh offers a broad lineup of high-quality synthetic zeolite products, consisting of the high-silica zeolite HSZ series and the zeolite molecular sieve Zeolum<sup>®</sup> series. The priority for the Specialty Group is to continue meeting steadily growing demand for HSZ products from the automotive, oil and energy, and environmental industries.

The group is boosting HSZ production capacity and developing HSZ innovations to accommodate rapidly evolving trends in industry requirements and environmental regulations. And Tosoh is constructing an HSZ manufacturing plant in Malaysia. That plant is scheduled for completion in late calendar year 2016, and sales are anticipated to begin in mid-2017. This will be the first production facility that Tosoh has built in Malaysia, and it will boost the company's HSZ production capacity 40%.

##### *Ceramics*

The goal of the Specialty Group's zirconia powder operations is to maintain top share of the global fine ceramics market. The group established Tosoh as a major player in the dental materials market when in 2011 it introduced Zpex<sup>®</sup>, a translucent, colored, high-strength grade of zirconia. In December 2014, it furthered Tosoh's presence in dental materials with the launch of Zpex Smile, a high-translucency zirconia for front teeth.

Zirconia's popularity in fashion parts for wristwatches, car accessories, and mobile phones is another opportunity for sales and profits growth for Tosoh's fine ceramics.

#### *Battery Materials*

Tosoh is the world's largest producer of electrolytic manganese dioxide (EMD) and a major supplier of EMD to the conventional battery market globally. And the Specialty Group helps maintain and expand the company's competitive position. The EMD market is mature and competitive, but there are opportunities for growth.

The Specialty Group, meanwhile, is establishing itself as a principal producer of manganese-based cathode materials for the lithium-ion secondary battery market. Demand for lithium-ion secondary batteries is anticipated to grow substantially, and the expanding market for electric vehicles is undeniably a market where Tosoh can contribute. In addition, rising standards of living, improving infrastructure, and growing personal incomes in emerging countries are expanding purchases of handheld, or portable, electronic devices, for which batteries are essential, presenting Tosoh with yet more opportunity to expand its business in battery materials.

#### *Electronic Materials*

Thin-film materials and quartz are other areas where the Specialty Group is expanding operations to meet growing demand. The semiconductor market should grow as demand rises for handheld devices, electronics in automobiles and other consumer products, and digital information technologies. So the Specialty Group is implementing measures to serve the next-generation memory and printable electronics markets and is developing and expanding sales of products for atomic layer deposition and coating applications.

#### *Bioscience*

##### *Separation and Purification*

Tosoh is committed to a major presence in the global bioscience market. Through its Specialty Group, it has established its bioscience brands in the leading markets of Japan, the United States, and nations in Europe. The group now targets high-growth markets in China, India, Southeast Asia, and the Middle East. Over the medium term, the focus is on selling high-performance liquid chromatography (HPLC) separation columns and Toyopearl separation media. Measures in fiscal 2015 to develop and launch grades of separation media and columns for ultrahigh-performance liquid chromatography (UHPLC) systems bore fruit in fiscal 2016 and will be followed by efforts to increase Tosoh's market share of the UHPLC market for years to come.

Globally, the Specialty Group seeks to increase its share of the separation media market by leveraging the popularity of its Toyopearl AF-r Protein A HC-650F product. The group developed this grade of Toyopearl to address biopharmaceutical industry demand for antibody purification media. Another group offering is Toyopearl Sulfate-650F, a separation and purification medium that Tosoh commercialized in October 2015.

## Clinical Diagnostics

Tosoh continues to build its worldwide presence in clinical diagnostic systems. The company has an especially positive reputation in the global diabetes market thanks to a line of Specialty Group glycohemoglobin (GHb) analyzers. And the group plans to increase Tosoh's share of this approximately ¥50 billion and rapidly growing market.

The Specialty Group's plans include producing compact, reasonably priced GHb analyzers suitable for developed and developing countries and expanding the support network for all of its GHb analyzer models. Its plans also encompass a 30% expansion of analyzer-related reagent production capacity, scheduled for completion in October 2016.

The global molecular testing market, too, is growing steadily and is estimated to be worth over ¥500 billion. Market growth is particularly strong in emerging countries, where molecular testing is most valued in testing for infectious diseases, for which Tosoh's nucleic-acid amplification testing products are particularly useful. The group has made steady inroads in the market, especially with its next-generation TRCReady-80 system.

## Medium-Term Business Plan

Tosoh's medium-term business plan targets ¥40 billion in operating income for the Specialty Group and an operating margin of 21.7% by fiscal 2019. These aims represent increases of ¥7.3 billion and of 3.0 percentage points, respectively, over fiscal 2016.

The three-year strategy for advanced materials is to develop new grades of and to boost production capacity for HSZ. Initiatives include improving the development system and building an HSZ production facility in Malaysia. Construction of the Malaysian plant is scheduled for completion in late 2016. Sales of its HSZ should start in mid-2017.

The zirconia product strategy is to continuously market distinctive grades while adding capacity. The Specialty Group will work on increasingly translucent zirconia dental materials and on accelerating development to meet customer needs. Tosoh, meanwhile, will complete a production capacity upgrade at the Yokkaichi Complex in fall 2016.

In EMD, quartz glass, and sputtering targets, the Specialty Group will focus on advanced functionality. This includes heightened differentiation in Tosoh's EMD. It also includes heightened competitiveness in quartz glass by reducing manufacturing costs and developing new materials. The group will also emphasize sputtering targets for touch screen applications and the development of high-performance products. Touch screen demand should grow as emerging economies follow developed countries in expanding smartphone usage.

The strategy for the group's organic chemicals operations in ethyleneamines, urethane foaming catalysts, and bromine and flame retardant product lines is to improve profitability and to stabilize new business. The Specialty Group is integral to Tosoh's aim of significantly

improving profitability by shifting to high molecular weight amines. At the same time, it will focus on sales of urethane foaming catalysts, most notably highly functional products for Toyocat, and on bolstering Tosoh's marketing in European nations and the United States for RZETA. Its efforts in bromine and flame retardants will be furthered by Tosoh's investment in more efficient bromine production facilities, which are slated for completion in spring 2017.

Overall, the strategy for bioscience instruments, columns, separation media, immunoassay analyzers, and reagents is to expand markets through R&D and acquisitions and to cultivate demand in emerging economies. Initiatives include acquiring new technologies and products.

The Specialty Group will develop columns and separation media for the biopharmaceutical market and increase production capacity for Toyoparl separation media. It has, meanwhile, complemented its fiscal 2015 launch of its diagnostic AIA<sup>®</sup>-CL2400 automated immunoassay analyzer with the compact AIA-CL1200. The group will expand distinctive reagents in growth areas and cultivate the Indian market, through Tosoh India, helped hugely by Tosoh's completion of its reagent production capacity enhancement in October 2016 to 30% beyond current capacity.

## CHLOR-ALKALI GROUP

### Snapshot

The Chlor-alkali Group operates the largest fully integrated manufacturing capacities of their kind for chemical commodities in Asia and supplies the worldwide chlor-alkali industry with raw materials for a vast range of products. It is well positioned to take advantage of opportunities, especially in Asia's expanding markets.

The group's main products are caustic soda, chlorine, vinyl chloride monomer (VCM), polyvinyl chloride (PVC) resins, calcium hypochlorite, sodium bicarbonate, methylene diphenyl diisocyanate (MDI), toluene diisocyanate (TDI), hexamethylene diisocyanate (HDI), and functional urethanes. It sells these raw materials to external customers and furnishes them as feedstock to Tosoh's fully integrated vinyl isocyanate chain, which yields the company's commodity and many specialty products.

The group's Urethane Division, established in fiscal 2015, oversees the production of MDI, an important raw material for polyurethane and a fine chemical with multiple uses in organic synthesis. MDI also offers attractive marketing synergies with Tosoh's diverse product lines, including organic synthesis compounds, polyurethane catalysts, and specialty polymers. TDI, too, serves myriad applications, many similar to those served by MDI. And HDI is a higher-value-added product with applications in high-performance paints and other specialty polymers.

The Chlor-alkali Group's chemical commodities business is thriving in tandem with the growth of economies worldwide and despite constantly changing shipment volumes and prices as

supply and demand fluctuate. The group has the know-how and systems to optimize its production mix to match circumstances and to enable Tosoh to compete globally in chlor-alkali.

The group also oversees Tosoh's cement operations, which use waste and coal ash, slag, and other by-products from Tosoh's operations and elsewhere. That valuable contribution to recycling also occasions a considerable reduction in the cost of manufacturing cement. The entire cement output is then consigned for sale by Taiheiyo Cement Corporation, Japan's largest cement manufacturer.

## Group Performance and Markets

### *Improved Profitability*

Chlor-alkali Group net sales decreased 4.9%, to ¥279.8 billion (US\$2.5 billion), in fiscal 2016. That represented 37.1% of Tosoh's consolidated net sales, up from 36.4% a year earlier. Operating income improved 116.2%, to ¥18.0 billion (US\$159.6 million), and contributed 25.9% of consolidated operating income. The operating margin was 6.4%, compared with 2.8% in fiscal 2015.

Shipments of caustic soda increased on the higher production volume ensuing from a rise in the operating rate of electrolysis equipment. Domestic caustic soda product prices declined slightly, however, while export prices improved owing to the weak yen. Shipments of VCM and PVC rose given a boost in VCM production capacity in fall 2014. But VCM and PVC product prices fell, largely because of a decline in the price of naphtha. Cement shipments in Japan decreased on account of falling demand. But cement exports increased. Shipments of urethane raw materials were down as a result of a slowdown in China's economy and softening demand overseas markets.

## Developments

### *Post-merger Progress*

In fiscal 2015, Tosoh absorbed its former subsidiary Nippon Polyurethane Industry Co., Ltd. (NPU). The two companies' operations were already tightly linked in a collaboration that turned Tosoh's vinyl chain into the fully integrated vinyl isocyanate chain that it is today. But Tosoh foresaw increasingly severe competition in isocyanates, so it opted to absorb NPU to accelerate decision-making, unify manufacturing, optimize R&D, and heighten management efficiency through a single management structure that will enable Tosoh to better react to changes in the operating environment.

### *Capital Investments*

Tosoh benefited in fiscal 2016 from earlier spending to significantly expand production capacity at the Nanyo Complex's No. 3 VCM Plant. The gain redressed a supply imbalance that had

existed between the company's VCM and PVC operations after an accident destroyed the No. 2 VCM Plant at the Nanyo Complex in fiscal 2012. It also permitted an increase in the electrolysis operating rate, which, in turn, raised the production capacity of one of the Chlor-alkali Group's chief products: caustic soda.

Tosoh subsidiary Taiyo Vinyl Corporation increased its annual PVC production capacity by 10,000 metric tons in October 2014. As such, it is positioned to accommodate substantial need for PVC in Japan to aid in recovering from 2011's Great East Japan Earthquake and in constructing the infrastructure for the 2020 Summer Olympics and Paralympics in Tokyo.

A highlight of fiscal 2016 was Tosoh's investment of around ¥1.5 billion to lift its stake in Philippines-based chlor-alkali manufacturer Mabuhay Vinyl Corporation (Mabuhay) from 39.92% to 87.97%, making it a Tosoh subsidiary. The goal was to augment Tosoh's efforts to strengthen its core vinyl isocyanate chain. Mabuhay is the only electrolytic chlor-alkali producer in the Philippines, where chlor-alkali sales are anticipated to enjoy stable growth. Tosoh's heightened investment in Mabuhay signals the importance of that company to Tosoh's vinyl isocyanate chain. Tosoh is working to integrate Mabuhay's management system with its own.

## Strategies and Outlook

### *Vinyl Isocyanate Chain*

The profitability of the vinyl isocyanate chain has been an issue for the Tosoh Group over the past decade. The chain's operations have faced stiff challenges from steadily rising naphtha and other raw material prices, from substantial expansion in worldwide production capacity, and from global financial crises and the yen's appreciation.

Most affected have been the Chlor-alkali Group's core VCM and PVC products. In addition to measures it is taking to reduce costs and raise the competitiveness of its products, the Chlor-alkali Group seeks to increase the production and sales of its most profitable chloride line of caustic soda and related products. The expansion of VCM production capacity at the Nanyo Complex and the resultant increase in the electrolysis operating rate that enabled the greater production of caustic soda are major steps toward that goal.

Exploiting the cost-effectiveness of Tosoh's independent electricity generation capabilities is another important way the Chlor-alkali Group is boosting the cost-competitiveness of its primary chloride and other product lines. The Chlor-alkali Group is devising methods to share Tosoh's electricity generation capabilities among its operations at the company's domestic factories, beginning with the Yokkaichi Complex, and at the Sakata Plant of Tohoku Tosoh Chemical Co., Ltd. Environmental taxes on fossil fuels will be implemented incrementally in Japan over the next few years, and the group's efforts to distribute Tosoh's electricity generation will contribute to keeping its electric power costs and its product pricing competitive.

The global VCM market is highly competitive but growing. So the Chlor-alkali Group employs a wide range of measures to reduce its VCM production costs and to strengthen its VCM marketing. The group is also considering prioritizing domestic and overseas markets where profitability is greatest amid changing exchange rates, market conditions, and technologies.

The group is focusing on products, including PVC, produced by Tosoh subsidiaries. Its plan is to encourage subsidiaries to collaborate in expanding markets in ways that ensure their profitability. The goals specifically for VCM and PVC operations are to provide stable VCM supplies to Tosoh's PVC manufacturing subsidiaries and to maximize profits for all. This means strengthening domestic sales and tapping sales opportunities overseas in such markets as Indonesia and India. China remains a difficult market because of its increasing use of the carbide method to produce PVC.

Tosoh produces more than 35% of Japan's VCM output and is the domestic leader in PVC resins, accounting for one-fourth of national output. Long term, VCM and PVC demand should increase in Asia, and Tosoh expects to benefit despite heightened competition at home and abroad.

#### *Urethanes*

The Chlor-alkali Group's Urethane Division embodies the full integration of Tosoh's and NPU's MDI, TDI, HDI, and functional urethane operations. From a single location within Tosoh's head office, the division's administrative staff is examining how best to optimize Tosoh's ample resources to further Tosoh's urethane business strategies. This will be particularly important in view of growing volatility in the polyurethane business climate amid raw material cost fluctuations, planned capacity increases by competitors, foreign exchange rate swings, Chinese market risks, and other factors.

Regardless of operating climate, the Urethane Division will pursue efforts to cultivate high-value-added MDI offerings and to reinforce its functional urethane business to bolster Tosoh's profitability. The division also looks to maximize production and sales to help stabilize Tosoh's vinyl isocyanate chain and increase the company's earnings.

Tosoh's conversion to low-cost MDI production was mostly complete before the integration of its vinyl isocyanate chain through the tie-up with NPU's operations. The Urethane Division is now contemplating additional MDI production capacity to increase the presence of Tosoh's MDI products domestically and overseas.

The division also intends to reinforce its MDI export sales structure. While reviewing its sales structure in China going forward, it will attempt to reduce its reliance on China's market. It will instead expand sales in Southeast and South Asia, which offer potential for stable demand. To reinforce its MDI marketing drive in Asia, particularly in ASEAN markets, the division has set up

an MDI stockpiling base in Singapore. At the same time, the division will strive for steady sales in North America.

Strengthening sales of monomeric MDI, meanwhile, is another divisional priority. And again it will attempt to do so in part by boosting sales outside China to offset concerns about demand among that nation's key users of monomeric MDI. The division will also promote sales of a special grade of monomeric MDI suitable for environmental issues and to meet growing demand from major footwear makers.

In addition, the Urethane Division is targeting a growing share of the overseas HDI market, primarily through expanded sales to US and European customers but also to customers elsewhere. The division also plans on expanding its sales of liquid polycarbonate diol (PCD), a highly pliable and tough raw material for polyurethane resin products, and of other of its products.

#### *Cement*

The Chlor-alkali Group's one-kiln cement operations lessen the group's fixed costs through low maintenance and labor and outsourcing expenses. Their improved waste plastic processing capacity and capability also contribute to operational profitability.

Medium term, the group is considering increasing the waste plastic processing of its cement operations. This will involve an upgrade to its cement manufacturing facilities alongside ongoing programs to conserve energy and reduce energy costs.

In fiscal 2017, the Chlor-alkali Group expects that demand for cement will remain steady. Demand related to the 2020 Summer Olympics and Paralympics in Tokyo should pick up in the second half of the year and offset a tapering off in domestic public-sector demand. Overseas, competition in Asia could intensify owing to slower growth in China. Tosoh, though, anticipates operating at full kiln production and sales capacity in fiscal 2017.

#### **Medium-Term Business Plan**

Under its three-year business plan, Tosoh's objective is ¥21 billion in operating income for the Chlor-alkali Group by fiscal 2019, up ¥3 billion from fiscal 2016. Tosoh is also aiming for a group operating margin of 7.6%, an increase of 1.2 percentage points over fiscal 2016.

Tosoh's strategy for its Chlor-alkali Group, and specifically for the group's PVC, VCM, caustic soda, and chlorine derivatives operations, is to maximize profits by optimizing the vinyl isocyanate chain. Initiatives include ensuring the stable procurement of competitively priced raw materials and building competitiveness through greater efficiencies in power generation, power consignment, and other areas. As well, Tosoh Group company Philippine Resins Industry, Inc., will boost PVC production, and Tosoh will strengthen the profitability of its soda and chlorine derivative products.

Tosoh, meanwhile, will continue its shift to high-value-added MDI production and to strengthen its functional urethane operations. This, accordingly, will accelerate the company's move from commodity to specialty products and from single-item to system sales. The Chlor-alkali Group will underpin Tosoh's strategies in this regard especially through an MDI marketing drive in Asia reinforced by the Urethane Division's MDI stockpiling base in Singapore. In addition, the division will promote sales of functional urethanes in medical fields and add production capacity for HDI derivatives.

## PETROCHEMICAL GROUP

### Snapshot

The Petrochemical Group supplies diverse customers with conventional and high-performance and specialty products. Polymers, including polyethylenes and functional polymers, and olefins are the group's main product lines, and the group maintains its competitive edge by moving its products upstream, managing its product mix, cutting its costs, and diversifying its product lines. The Petrochemical Group bridges the gap between the Specialty and Chlor-alkali Groups in Tosoh's dual commodities and specialties strategy.

Tosoh has utilized olefin feedstock from the Petrochemical Group to become an integrated manufacturer of hydrocarbon-based products and their derivatives, including ethylene, propylene, cumene, and aromatic compounds. Customers use olefins to manufacture a broad range of products, from automotive additives to food flavors and fragrances.

The Petrochemical Group's polymer operations manufacture ethylene vinyl acetate (EVA); low-density polyethylene (LDPE); linear low-density polyethylene (LLDPE); high-density polyethylene (HDPE); and such functional polymers as chloroprene rubber (CR), adhesive polymers, and engineering plastic resins. The polymer operations adapt product specifications to meet customer needs for polymers in consumer and industrial products. Various grades of EVA are found in everything from solar cells to shoe soles. LDPE is used in medical applications and food packaging. And HDPE is applied in injection moldings and high-purity pharmaceutical containers.

Chlorosulphonated polyethylene (CSM) rubber and polyphenylene sulfide (PPS) feature in the Petrochemical Group's functional polymer lineup. CSM is a highly durable rubber, and Tosoh is the leading global CSM producer. PPS is also in great demand globally as an engineering plastic, as it helps automakers develop lighter, more fuel efficient vehicles.

### Group Performance and Markets

#### *Significantly Improved Profitability*

The Petrochemical Group's net sales decreased 21.6% from a year earlier, to ¥175.4 billion (US\$1.5 billion). The group's contribution to Tosoh's consolidated net sales likewise declined,

from 27.6% to 23.3%. In contrast, operating income rose ¥4.7 billion, or 67.7%, to ¥11.6 billion (US\$103.0 million), owing to increased sales volumes and accounted for 16.7% of Tosoh's consolidated operating income. The group's operating margin was 6.6%, up from 3.1% a year earlier.

Among shipments of olefin products, cumene shipments rose because of increased demand for derivatives. The cumene market, though, weakened abroad, and decreases in the cost of raw material feedstocks translated into low prices for cumene products in the Japanese market.

Shipments of polyethylene resin increased amid improved trade conditions for exports because of the weak yen and lower raw material prices. But polyethylene resin product prices in Japan declined, reflecting falling naphtha prices. The weak yen, meanwhile, improved export prices for CR and CSM.

### Developments

During the period under review, Tosoh allocated around ¥1.9 billion to Petrochemical Group R&D. The group, in turn, continued and continues to develop and commercialize new grades of polyethylene suited for use in infusion bags that are heat resistant and transparent and that meet Japan's safety standards. The group also plans to develop and sell variations of its two newest polyethylene grades for application in medical bottles, ampoules, and unit-dosage dispensers for eyedrops and other medicines. Sampling is under way.

The Petrochemical Group, meanwhile, continued its development in fiscal 2016 of a CR grade with well-balanced heat-resistance and dynamic properties. Its work on developing a new rubber polymer with enhanced oil resistance was and is likewise ongoing. R&D during the year under review also encompassed developing specialty PVC paste grades for wallpaper, flooring, and automotive materials. As well, work continued on the development of new polymers based on proprietary concepts for liquid crystal optical materials, flexible display substrate materials, and other applications.

### Strategies and Outlook

#### *Olefins*

One of Tosoh's domestic competitors shut down its ethylene plant in fiscal 2015 and thereby improved the supply and demand for olefins in Japan. The resultant decline in supply has allowed Tosoh's Nanyo Complex to raise the operating rates of its ethylene production facilities and to thereby lower costs at those facilities.

In Asia, the Petrochemical Group sees olefins as a growth market in the long term despite rising competition from Middle Eastern and Asian suppliers. Developing economies invariably consume increasingly large amounts of olefins, as is happening throughout the Asia-Pacific region, and the group maintains some advantages over competitors in many markets.

The Petrochemical Group relies on its refinery and petrochemical modeling system (RPMS) to deal with a changing business environment. It adjusts the mix of its cracker output, for instance, to maximize profitability. As a result, it is prepared to expand by taking advantage of opportunities that arise from managing the balance among production rates, product mix, and market prices.

#### *Polyethylenes*

A significant amount of polyethylene from the United States should flow into the Chinese and other Asian markets in the year ahead. This could affect cracker operating rates, but those markets should be able to absorb the surplus polyethylene.

The Petrochemical Group's strategy for its core polyethylene products is differentiation. It will focus on high-value-added grades, new products, and customization for market segments and major customers.

#### *Functional Polymers*

The Petrochemical Group is repositioning itself in the technically advanced segment of the CR market by expanding its line of superior-grade products. This includes introducing injection-mold and sulfur-modified CR grades.

Even without the advantage of a weak yen, Tosoh has been the world's top supplier of CSM to the high-end market for many years. To maintain and further that position, the Petrochemical Group has an ongoing product development program and plans for production capacity expansion in line with sales growth.

Demand for PPS resins from the principal customer for these products, the global automobile industry, is estimated to grow over the medium term. The Petrochemical Group is poised to meet that demand and continues to develop PPS grades for new applications in automotive parts to aid automakers reduce vehicle weight. The latter include already-developed Susteel<sup>®</sup>-brand PPS, which features superior metal bonding for automotive applications. Also included is SGX-grade PPS resin, which a leading smartphone maker began using in its mobile phone casings in 2013. Several Chinese smartphone makers have subsequently also begun using SGX-grade PPS resin.

#### **Medium-Term Business Plan**

Tosoh's medium-term business plan has as an objective ¥17 billion in operating income for the Petrochemical Group by fiscal 2019. This represents a 46.6% rise over the three years from fiscal 2016. The plan also aims for an operating margin of 10.4% for the group, an increase of 3.7 percentage points over fiscal 2016.

The plan's focus in olefins is on ethylene, propylene, and cumene. A priority will be to optimize earnings by maintaining high-capacity utilization rates for the Petrochemical Group's naphtha crackers. As part of that effort, the group will work to enhance its energy-intensity competitiveness and to build a pricing structure that incorporates an appropriate spread. The Petrochemical Group relies on its RPMS to deal with a changing business environment. It adjusts the mix of its cracker output, for instance, to maximize profitability. As a result, it is prepared to expand by taking advantage of opportunities that arise from managing the balance among production rates, product mix, and market prices.

Polymers, too, figure in the medium-term business plan, where the emphasis is on polyethylene and the functional polymers CR and CSM. The Petrochemical Group's overall thrust in polymers is on differentiating its offerings and ensuring high added value. Its aim specifically for polyethylene is to expand domestic sales of specialty offerings for food, medical, and electronics applications and to cultivate overseas markets. Another priority for polyethylene is to boost quality to penetrate high-end markets.

The focus in functional polymers is to expand sales of special grades of CR, particularly of sulfur-modified and injection-mold CR. The group will also establish a second CSM plant and carry on with its plan to introduce a polymer with enhanced oil resistance.

#### **ENGINEERING GROUP**

##### **Snapshot**

The Engineering Group comprises water treatment and pure water generation leader Organo Corporation and construction company Tohoku Denki Tekko Co., Ltd.

Organo maintains three principal businesses. Its plant business sells water treatment systems to electronics, chemicals, oil refinery, food and beverage, paper and pulp, waterworks and sewage treatment, health care, and other companies. Its solution business maintains and manages systems, suggests ways to enhance efficiency and lower environmental impact, and provides water treatment outsourcing services. And its functional products business sells standardized water treatment systems and chemicals and food processing materials.

Tohoku Denki Tekko has five main businesses. The construction business engages in machinery, plant, steel structure, environmental and sanitation facilities, and container construction. Its four other businesses encompass electrical machinery, instrumentation, civil engineering, quality assurance, and maintenance.

## Group Performance and Markets

### *A Solid Performance*

In fiscal 2016, the Engineering Group's net sales amounted to ¥84.2 billion (US\$747.1 million), an improvement of 11.1% over fiscal 2015. The group's operating income climbed 37.4%, to ¥4.6 billion (US\$40.6 million). The group accounted for 11.2% of Tosoh's consolidated net sales, compared with 9.4% the previous fiscal year. Its operating margin was 5.5%, a decline of 6.5% from fiscal 2015.

Domestic sales of water treatment facilities, services, and related chemicals were up. This reflected growth in plant construction and requests for maintenance and renovation overall in the water treatment industry, primarily for the electronics sector. Overseas sales rose largely as a result of increased demand from a rising number of electronics plants, one demand driver being Taiwan. Sales were down at construction subsidiaries.

### **Developments**

#### *Strategic Collaborations*

Organo has taken steps to consolidate its businesses and expand its service capabilities. Those steps include forming a business alliance with Katayama Nalco Inc. in fiscal 2014 that sees the two companies collaborating to expand their water treatment businesses. Organo's chief products are in water and wastewater treatment chemicals, while Katayama Nalco's core lines are process-related chemicals for steel, petrochemicals, and pulp and paper. The alliance should contribute significantly to the Engineering Group's net sales in the years ahead.

A fiscal 2016 Engineering Group highlight was the launch of a water treatment joint venture in India in September 2015 with the India-based Muragappa Group. Organo owns 49% of the joint venture, called Muragappa Organo Water Solutions, which targets Japanese and non-Japanese customers in India and aims to serve the emerging needs of manufacturers there.

### **Strategies and Outlook**

#### *Water Treatment*

In fiscal 2017, Tosoh subsidiary Organo Corporation intends to bolster its earnings capacity, develop and improve technologies and products that strengthen its businesses, and allocate resources to bolster R&D activities as part of efforts to generate long-term growth. Organo's management expects that sales will remain basically unchanged but that operating income will probably decline, reflecting a downturn in solution business sales in its water treatment business. Organo's management also anticipates significantly increased capital investment.

Large electronics industry projects should again contribute to Organo's performance, although domestic and overseas orders in that industry will probably be down. In addition, Organo will target sales to the water treatment chemicals industry and reinforce its solutions business while continuing to reduce costs to improve profitability.

Organo hopes to capture opportunities emerging from planned construction in the Tokyo area. This includes in particular construction for the 2020 Tokyo Summer Olympics and Paralympics and the linear motor car project of Japan's major railway company.

A mature domestic market, meanwhile, compels Organo to increasingly look abroad for business especially in water treatment for power stations. Organo is thus leveraging its network of subsidiaries and affiliates in China, Thailand, Malaysia, Taiwan, Vietnam, and Indonesia and converting its overseas activities to local operation and staffing as appropriate.

Organo has revised its medium-term business plan in view of a more challenging business outlook for Japan and overseas, particularly in view of a prolonged slowdown of the Chinese economy. It has accordingly positioned itself to expand market share and to secure solid revenues even in shrinking markets, largely by updating its management plan annually to address fluctuations in its business environment.

#### *Construction*

Tohoku Denki Tekko will continue to enhance its cost structure and public works labor and material costs. The subsidiary's strategic objectives include adopting a solutions-oriented sales approach in its industrial electrical machinery businesses that goes beyond hardware to planning, construction, and installation. New business is always a priority. And the subsidiary will develop its bag filter system business to lift its reputation as a systems provider.

### **Medium-Term Business Plan**

Over the next three years, Organo will prioritize areas offering the most potential. It will cultivate domestic business for power plants and establish operations overseas where electricity demand is expanding. It will also enhance its equipment and systems businesses for the supply of ultrapure water and other washing agents. Measures for functional products will include developing and improving the functionality of products for standardized water treatment equipment, developing functions for ion-exchange resins and other materials, and expanding scale by cultivating new markets.

The Engineering Group's construction-related priorities will be on bolstering Tohoku Denki Tekko's technological and service capabilities. This will be part of efforts to optimize customer satisfaction.

## OTHER

### Snapshot

Tosoh is committed to close connections among its business operations and customers. It relies on its other businesses to ensure those connections. Timely support of its diverse operations is mission critical for Tosoh. Tosoh's other businesses, therefore, are always on call.

In addition to trading companies, Tosoh's other businesses include professional services that assist the Tosoh Group. These include logistics, administrative services, personnel training, information technology (IT) support, and more. Other businesses also contribute essential research and analytical support for Tosoh's introduction of innovative technologies, products, and services.

Tosoh works to ensure that each of its other businesses evolves from a cost center to a profit center. And it ensures that they compete with external suppliers for Tosoh Group business, which benefits them and the Tosoh Group by promoting cost- and administrative effectiveness and technological advances.

### Group Performance and Markets

#### *A Solid Performance in a Challenging Environment*

Other sales declined 3.1%, to ¥39.7 billion (US\$352.6 million), and accounted for 5.3% of Tosoh's consolidated net sales, an increase from 5.1% a year earlier. Operating income was down 9.6%, to ¥2.6 billion (US\$22.8 million), and the group's operating margin, at 6.5%, was also down, from 6.9% in fiscal 2015.

The main factor in the declines was a drop in trading company sales, which offset robust sales at logistics subsidiaries.

### Strategies and Outlook

#### *Logistics*

Logistical support for Tosoh Group companies falls into four categories. The first is to reduce manpower requirements and improve efficiency. The second is to provide risk management processes and other procedures to upgrade safety and quality. The third is to ensure that shipping terminals and warehouses can meet changing needs and optimize shipping route traffic. The fourth is to support overseas expansion.

The Urethane Division that Tosoh formed as a result of its merger with NPU will benefit from ongoing logistical support. Tosoh's other businesses will furnish that division with the logistics it needs to integrate its operations and capture synergies. They will also provide logistics to help the Urethane Division and Tosoh Silica Corporation improve their earnings.

#### *General Services*

Tosoh has established other, general services businesses to handle personnel management and employee benefit administration and training. They also encourage subsidiary and affiliate participation in the Tosoh Group salary administration system to further ongoing efforts to raise group-wide efficiency. Tosoh's general services businesses, moreover, seek to expand and enhance their offerings to optimize the health and safety of Tosoh Group employees.

#### *Analysis and Research*

Tosoh's analysis and research businesses provide an array of sophisticated services to Tosoh Group companies worldwide. These businesses specialize in the organic, inorganic, and polymer chemistry and the electronic materials that underpin Tosoh's product and application development programs.

They also prioritize bolstering Tosoh's technical capabilities, brand reputation, and profitability. They accordingly engage in structural analysis, organic chemistry, surface analysis, high molecular weight polymers, and inorganic chemistry for Tosoh Group companies. Around half of their analysis and research is at the Nanyo Complex, while the remainder is at the Yokkaichi Complex and at various Tokyo-based Tosoh operations.

To maintain first-rate analysis and research capabilities, Tosoh annually allots related other businesses a substantial equipment budget. This enables annual installations of state-of-the-art equipment to upgrade analysis and research for the Tosoh Group. And that, in turn, helps those businesses to become more marketable outside the Tosoh Group in striving to become strong, independent profit centers for Tosoh. External sales in analysis and research have edged up in recent years, and there is every expectation that these operations will cultivate more work from external customers going forward.

#### *Information Systems*

Other businesses offering information systems services maintain servers, personal computers, and networks across dozens of domestic companies. Their work spans administrative and factory operation systems. And their development of an enterprise resource planning system allows Tosoh management to assess the performance of Tosoh Group members in deploying and employing information systems.

Information systems-related other businesses are tasked with evaluating and introducing technologies, systems, and services. They also maintain and upgrade systems and services across the Tosoh Group and thereby reduce group-wide IT costs.

The other businesses involved with information systems services continue to reinforce the skills of their employees through education. Specific areas of training include learning how to write applications for the group's core IT systems, acquiring proficiency in diverse programming languages, and cultivating skills in innovation and process improvement.