

## JAPAN VILENE

### OVERVIEW

Tokyo-headquartered Japan Vilene, which celebrated its 50<sup>th</sup> anniversary in 2010, was established as a nonwoven fabrics manufacturer in 1960 as a joint venture between **Freudenberg**, of Weinheim, Germany, and two Tokyo-headquartered Japanese companies—Dainippon Ink and Chemicals, and **Toray Industries**. **Freudenberg** currently has a 27.6% share in ownership of the company and **Toray** 12%, with the balance of the shares now in the hands of various investors such as banks.

Over the years, Japan Vilene has developed and expanded its core business in nonwovens together with its customers in the domestic market, as well as in different parts of the world such as China, Taiwan, Korea, Southeast Asia and North America, becoming locally based in each area.

The strong partnership with **Freudenberg** also gives the company a key edge in terms of global reach and market presence. The two companies work closely together on an international basis through a constant exchange of management, research and development (R&D), and marketing information.

Before 2007, Japan Vilene's activities were split into six divisions—Air Filters, Apparel, Automotive, Electrical, Industrial and Medical, and Consumer. These became four, as described in the following sections, until the financial report for the year to 31 March 2011, when the company streamlined its activities into just two specific businesses—Automotive Materials Business and Industrial Materials Business, with the latter housing all business not pertaining to service to the automotive industry.

### AUTOMOTIVE

This business is centred on automotive components such as headliners, interior materials, engine-intake air filters and floor mats, in addition to wipes and polyester (PES) fibres.

Historically, Vilene's Friedr R needlepunched floor mats were adopted by Toyota in 1975, and in 1979 Vilene developed the DX-R and DX-S mats made from needlepunched nonwoven fabric, rubber and vinyl chloride. In 1985, thick-piled shaggy-type carpet was introduced mainly for high-end Toyota and Mitsubishi models and the company has continued to develop new products with added functions – such as sound absorption, odour elimination and low content of volatile organic compounds (VOCs) – as its business has grown globally. A further introduction was three-dimensional (3D) mats produced without the use of binders.

Vilene initially produced car mats in collaboration with existing companies and then established its own company, Hikotomi Industrial, in Hikone City, Japan, in 1983. In February 2007, the company then founded Japan VIAM as a wholly owned subsidiary. In

April 2009, the floor mat business of Hikotomi Industrial was acquired and transferred to Japan VIAM. The company is manufacturing car mats at its plant in Shiga in direct response to the strategies of Japan's car builders.

Japan Vilene began US production with the establishment of VIAM in Santa Fe Springs, California, in 1983. In 1998, it opened a second North American VIAM plant in Manchester, Tennessee, and in 2004 a further facility adjoining the existing Tennessee plant was opened.

By 2006, the global VIAM operations had annual sales of ¥8.7 billion, with the plants in California and Tennessee having a combined capacity of 400 000 units for customers including both Japanese companies and the USA's so-called "Big Three" automobile manufacturers—Ford, General Motors and Chrysler.

In March 2011, a ground-breaking ceremony took place in Manchester, Tennessee, for another VIAM plant that is now producing and selling recycled polyethylene terephthalate (PET) fibres for the automotive market in North America. Construction was completed in October 2011 and production commenced in January 2012.

In line with the continually growing Chinese auto market, Tianjin VIAM, established in 1984, announced in 2011 that it would move to a new factory in Tianjin in order to increase annual production capacity to over 120 000 sets of floor mats. Production here also commenced in January 2012.

Automotive headliners and interior materials are also manufactured and sold by four companies in the Japan Vilene Group: the company's Shiga plant; **Freudenberg** Vitech in Hopkinsville, Kentucky, USA; **Freudenberg** & Vilene Nonwovens in Suzhou, China; Korea Vilene in Seoul, South Korea. These companies all employ recycled PET fibre materials made by Oyama Chemical of Oyama, Japan, and subsidiary Korea Vilene in Seoul.

#### **AIR FILTERS**

The company's range of air filters includes both coarse- and fine-class filters, automatic roll filters, equipment filters, car-cabin air filters and dust collectors.

The company reports that there is now intense competition in this field, yet its sales of car-cabin air filters increased during the year to March 2011, and again in the year to March 2012, as demand remained solid in Asia.

In partnership with **Freudenberg**, Japan Vilene's Air Filters division opened a facility in China, where **Freudenberg** and Japan Vilene Filter Changchun began the production of automotive air filters in January 2005 in Changchun's Economic and Technology Development Zone, achieving sales of ¥1.3 billion in the first year. This business is servicing the automotive companies of northeast and northwest China with a range of products including air filters for engines and cabins.

In January 2005, Japan Vilene released its Ecoalpha series of air filters, which were developed using Life Cycle Assessment (LCA) techniques for evaluating the environmental burden of products throughout their lifespan.

Ecoalpha incorporates Vilene's proprietary continuous density-gradient nonwoven filter media for tailored performance of the filter. Each filter has the capacity to reduce carbon dioxide (CO<sub>2</sub>) emissions by approximately 100 kg annually, which is higher than existing filters of the same class. In addition, they are more compact, lighter and said to consume around 24% less power than existing products. Significantly, they can also be recycled in a system developed by the company in which recovered filters are pulverized by an intermediate processor and then used as furnace materials. This enables a reduction in the use of restricted chemical substances (such as halogens, formalin and VOCs).

The Vilo Salt and Vilo Pleats filtration ranges were introduced in September 2005.

Vilo Salt media is effective in preventing salt corrosion of air-conditioning ducts and the subsequent potential damage to office and production equipment. Consisting of highly water-repellent fibres, the filter media almost completely prevents the downstream flow of salt particles.

Vilo Pleats employs microfine polypropylene (PP) filter media with thin and lightweight pleats 65 mm deep, which save on the amount of material required for a given efficiency.

Other new product ranges recently introduced by the company include a 5-g.m<sup>-2</sup> nonwoven in widths of up to 1 m for medical and filtration products, based on electrospun 25-nm polyacrylonitrile (PAN) fibres. In addition, nonwovens with photocatalytic properties produced without binders, as well as products made from biodegradable polylactic acid (PLA) are now being produced.

#### **APPAREL AND MEDICAL**

Japan Vilene's sales of apparel materials – primarily interlinings, but also bonded waddings and handicraft products – have noticeably slipped in recent years.

Domestic Japanese demand for apparel materials continues to decline owing to the ongoing trend of Japanese companies shifting their sewing materials and/or procuring overseas.

However, in April 2005, **Freudenberg** and Japan Vilene acquired Nantong Hymo Co, the Chinese market leader in shirt interlinings, as well as one of the leading finishing companies for woven and weft interlinings. Nantong Hymo, based in Nantong, Jiangsu Province, was established in 1985 and is today known for its high-quality finishing technologies.

The acquisition further extended the leading market position of the **Freudenberg** and Vilene joint venture as a supplier to the garment industry and has increased its rate of growth in Asia. **Freudenberg** and Vilene's interlining business now has some 1000 employees throughout Asia, operating five factories in: Suzhou and Nantong in China; Seoul, Korea; Yang-Mei, Taiwan; Chennai, India.

In March 2007, the joint venture started production of a new spraybonded fibrefill line with an annual output of two million square metres at Suzhou. This is in addition to the output of an annual one million square metres of interlining materials. Considerable investment in additional technologies has also taken place at Nantong Hymo subsequent to its acquisition.

Vilene's latest product for the interlinings market is Hyper-Brid, characterized by two-way (vertical and horizontal) directional stretch as a result of a proprietary manufacturing process. Consequently, Hyper-Brid is especially suited as an interlining for knitted fabrics that also stretch.

It is already being used in the fronts and small parts of private-label knit jackets made for a famous men's store chain in Japan and other applications such as shoulder pads are being targeted.

Japan Vilene medical products include pharmaceutical materials, cosmetic base products, mops, hospital supplies, masks and product packaging for foods.

Among its recent products is the X-3500 series of metal-free disposable masks sold in Asia by Tokyo-based subsidiary Vilene Create.

Another recent development from a joint research project in Japan with Kyushu University and the Biotechnology and Food Research Institute of Fukuoka is a 3D cell-culture scaffold made using silica nanofibre nonwovens. The nanofibre fabrics consist only of silica glass created using the company's proprietary electrostatic spinning technology, which eliminates the need for organic binders and so has minimal adverse effects on cells.

The biocompatibility of silica enables stable culturing, while the pore diameter, controlled by a special electrospinning technology, has enabled the scaffold to achieve a higher culturing speed and higher culture density than is possible with conventional scaffolds. In addition, because cells are cultured in a 3D structure that is similar to a tissue in a living organism, the expression of superior cell functions is possible. The transparency of silica also allows the observation of living cells with an optical microscope as the cells are being cultured.

Japan Vilene has been working to commercialize the scaffold, starting with versions of a size compatible with that of culture wells for experiments and research. The new product is expected to contribute to research into biological functions, the production of protein and pharmaceutical products, tissue-engineering materials, drug-effect

analysis, and test kits. In addition, the company is building a bioreactor system incorporating this scaffold, and is now carrying out advanced research with a view to mass-production of antibody drugs and biotechnology-based pharmaceuticals.

#### **INDUSTRIAL AND ELECTRICAL**

This division makes various products for the industrial, information and audio equipment industries, shoe and bag backing materials, electrical insulation products and battery separators.

The company's sales of separators in small nickel–cadmium and nickel–hydrogen secondary batteries have been falling owing to adverse market conditions and rising nickel prices, but the company is benefitting from higher sales of hybrid vehicles, especially in North America, as the price of fossil fuel soars.

Recently, a new highly heat-resistant nonwoven separator for lithium-ion batteries has been developed. This is made from specially processed polyolefin microfibres to which inorganic fine nanoparticles are attached, in order to enhance the heat-resistance. The finished product is only between 20 and 30 µm thick, and effectively prevents direct contact between the cathodes and anodes of the lithium-ion batteries, while enabling ions to run through its micropores.

Existing separators often consist of three-layer polyolefin films, which have the disadvantage of potentially shrinking or melting if heated to over 130°C, requiring special systems to prevent electrical shorts. The inorganic chemicals incorporated into the new separator eliminate this need.

Japan Vilene already has an almost 100% share of the Japanese market for separators for nickel–hydrogen batteries for automotives, and in entering into the lithium-ion battery market anticipates an estimated ¥100 million in sales in 2014 for the new product. The company's current pilot plant for lithium-ion battery products has an annual capacity of two million square metres, and a bulk production line is currently being built, with an anticipated annual capacity of 30 million square metres once in full production by 2014.

Other success stories for this division in recent years include liquid filters for cartridges employed in semiconductor devices and separation membranes for use in wastewater treatment.

#### **FINANCIAL PERFORMANCE**

Japan Vilene's net income fell significantly in the year to 31 March 2009 and the company has been trying to return to a level approaching the years of 2007 and 2008, both in terms of turnover and income.

Operating income for the year to 31 March 2012, however, was down 56% on the previous year, primarily as a result of a steep fall in the sale of automotive floor mats in North America, and net income was down 38.5%.

**Japan Vilene: financial performance 2007–2012<sup>(1)</sup>**

Financial year (¥ billion)	2007	2008	2009	2010	2011	2012
Net sales <sup>(2)</sup>	56.3	59.0	50.2	45.8	46.0	44.1
Operating income	3.1	3.9	1.3	1.7	2.2	1.0
Net income	2.9	2.4	0.7	1.3	2.2	1.4

<sup>(1)</sup> Financial year runs to 31 March;

<sup>(2)</sup> Net sales figures include other business (see also, footnotes 4 and 5 for table below).

**Japan Vilene: sales by division 2007–2012<sup>(1)</sup>**

Financial year (¥ billion)	2007 <sup>(4)</sup>	2008 <sup>(4)</sup>	2009 <sup>(4)</sup>	2010 <sup>(4)</sup>	2011 <sup>(5)</sup>	2012 <sup>(5)</sup>
Apparel and Medical <sup>(2)</sup>	11.6	11.4	10.5	10.1	8.8	8.8
Industrial and Electrical <sup>(2)</sup>	10.4	10.6	8.7	9.8	10.2	9.5
Automotive	23.9	26.6	21.6	17.7	19.1	18.0
Air Filters	8.8	8.6	8.6	6.9	7.0	7.0
Industrial Materials Business <sup>(3)</sup>					26.6	25.8
Automotive Materials Business <sup>(3)</sup>					19.4	18.3

<sup>(1)</sup> Financial year runs to 31 March;

<sup>(2)</sup> Reported as different divisions pre-2007;

<sup>(3)</sup> Simplified structure from 2011;

<sup>(4)</sup> Figures for other business not shown;

<sup>(5)</sup> Figures for other business now included in those for Industrial Materials and Automotive Materials.

The continued increase in automotive business in North America in particular, came to a halt in 2009, and now it is sales in China that are reinforcing performance. Other divisions remain largely stable, or have fallen to some extent in the past few years.

**OUTLOOK**

In launching its Engineering Fabric Innovation initiative during 2010, Japan Vilene identified the areas in which it will seek to expand beyond the continuous development of its established technologies and markets. These are via the use of nonwovens as:

- capacitor separators;
- lithium-ion battery separators;

- fuel-cell components;
- nano-scale sound-absorbing materials;
- ultra heat spreaders;
- bioreactors;
- dye-sensitized solar-cell components;
- base materials for transdermal patches;
- environmental purification filters;
- anti-viral filters;
- cell culture sheets.

In addition to the progress already made in some of these areas (see above), Japan Vilene's Tokyo factory was equipped during 2010 with a new production line for transdermal patch applications in the medical market.

The global business for transdermal patches has seen tremendous growth over the past few years, with future prospects looking bright. The increase in production capacity is enabling Japan Vilene to expand into the European and American markets with some of its products that are already best-sellers in Japan.

With all of its current businesses flat, or even eroding, Japan Vilene aims to achieve total new business sales of ¥13 billion by the year ending 31 March 2015. It has many smart technologies currently in the pipeline and needs to see some of them taking off quickly.

The company is also seeking to boost its overseas sales and income via both its own and **Freudenberg's** sales channels, and production bases that are now being strategically equipped in response to the growth of Asian markets outside of Japan.