Contents

Foreword ................................................................................................................................3
1. Introduction .........................................................................................................................7
2. Car and light vehicle production by region ......................................................................23
3. Insulation, NVH materials and exterior textile parts .......................................................29
   Aunde ...............................................................................................................................31
   Autoneum .......................................................................................................................33
   Röchling .........................................................................................................................39
4. Textiles in automotive filtration ......................................................................................41
   Cummins ..........................................................................................................................43
   Donaldson .......................................................................................................................45
   Mahle ...............................................................................................................................49
   Mann+Hummel ..............................................................................................................51
   Parker Hannifin .............................................................................................................55
   Sogefi ..............................................................................................................................59
   Toyoobo ..........................................................................................................................61
5. Carpet, interior trim and headliners ..................................................................................65
   Adler Pelzer ....................................................................................................................67
   Asahi Kasei .....................................................................................................................71
   Auria ...............................................................................................................................77
   CAIP ...............................................................................................................................79
   Faceltia ............................................................................................................................81
   Fleetmister .......................................................................................................................89
   Grupo Autoneum ..........................................................................................................107
   International Automotive Components ..........................................................................109
   Teijin ..............................................................................................................................115
   Toyota Boshoku ...........................................................................................................119
   Yanfeng Automotive Interiors .......................................................................................123
6. Key Tier 2 suppliers .........................................................................................................129
   3M ...................................................................................................................................131
   Ahlstrom-Munksjö .........................................................................................................133
   Alcantara .......................................................................................................................137
   AstenJohnson ...............................................................................................................139
   Autins .............................................................................................................................141
   Berry ..............................................................................................................................145
   Borgers ..........................................................................................................................147
   BWF ...............................................................................................................................151
   Carcoustics ....................................................................................................................153
   DuPont ...........................................................................................................................155
   EcoTechnilin ..................................................................................................................159
   ELeather .......................................................................................................................161
   ELG Carbon Fibre .........................................................................................................163
   Fibertex Nonwovens .................................................................................................165
   Filtration Group ..........................................................................................................167
   Grupo Copo ..................................................................................................................169
   Haartz ............................................................................................................................173
   HKO ...............................................................................................................................175
   Hollingsworth & Vose .................................................................................................177
   Janesville .......................................................................................................................179
<table>
<thead>
<tr>
<th>Company</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Cotton</td>
<td>183</td>
</tr>
<tr>
<td>Johns Manville</td>
<td>185</td>
</tr>
<tr>
<td>KAP Automotive Components</td>
<td>187</td>
</tr>
<tr>
<td>Kasai Kogyo</td>
<td>189</td>
</tr>
<tr>
<td>Kolon Glotech</td>
<td>191</td>
</tr>
<tr>
<td>Lydall</td>
<td>193</td>
</tr>
<tr>
<td>Mogul</td>
<td>197</td>
</tr>
<tr>
<td>Neenah</td>
<td>199</td>
</tr>
<tr>
<td>Sandler</td>
<td>201</td>
</tr>
<tr>
<td>Shawmut</td>
<td>203</td>
</tr>
<tr>
<td>Soteria</td>
<td>207</td>
</tr>
<tr>
<td>Supreme Treon</td>
<td>211</td>
</tr>
<tr>
<td>Tenowo</td>
<td>213</td>
</tr>
<tr>
<td>Trèves</td>
<td>217</td>
</tr>
<tr>
<td>Glossary</td>
<td>219</td>
</tr>
<tr>
<td>List of tables</td>
<td>249</td>
</tr>
</tbody>
</table>
1. Introduction

There is currently frenzied activity and investment taking place to commercialise self-driving cars, involving both the established vehicle manufacturers and the technology giants of Silicon Valley. It is not an exaggeration to say that this could completely reshape the landscape of the global automotive industry once again – even after the massive shifts that have occurred since the beginning of the 21st century.

As Swamy Kotagiri, chief technology officer at leading Tier 1* supplier Magna International has observed, both suppliers and automakers are pushing the pace of technology as never before. In the past five years, he notes, more than 1,700 disruptive companies have introduced new technologies that could be applied to the automotive industry. At the same time, millions of students are learning about robotics, user experience design, machine learning, computer science and dozens of other fields that will impact transportation in the future.

For Patrick Koller, chief executive officer of another leading Tier 1 automotive components supplier, Faurecia, China holds the key, having set its sights on becoming the technology and innovation leader in the new domains of artificial intelligence, the internet of things, 5G, etc. Koller believes China’s giant communication and consumer electronics companies, such as Alibaba, Baidu, Huawei, Tencent and Xiaomi, will become as ubiquitous as Ford or General Motors or even Amazon, Facebook and Google in the coming years. (Faurecia is one multinational that has rapidly repositioned itself in response to the anticipated changes.)

Silicon Valley and the tech industry have poured billions of dollars into partnerships and design teams in the push to create self-driving cars and the traditional original equipment manufacturers (OEMs) were not immediately ready for this. They have, however, been faced with a simple choice:

• surrender a lucrative portion of business to Silicon Valley and risk ending up becoming mere subcontractors, making the shells to which sensors and software are added. In the longer term, this implies not only much lower profits, but also the loss of revenue from maintenance and service and a lesser relationship with car buyers;
• treat the technology companies as suppliers and learn how to build autonomous vehicles in-house.

Not surprisingly, they are going for the second option.

* The terms Tier 1 and Tier 2, which are most widely, but not exclusively, employed in the automotive industry, are not official designations and neither do they reflect how big or influential a company may actually be.

Generally they refer to who the end-user of a company’s products is, with Tier 1 manufacturers supplying directly to the OEMs – the name-brand car makers – often on a “just in time” or “in-sequence” basis, with materials and components assembled to specific orders and delivered on a pre-determined schedule directly to an automotive assembly line. As a result, the manufacturing plants of Tier 1 companies are generally in close proximity to their customers.

In turn, a Tier 2 supplier will sell to a Tier 1, and a Tier 3 to a Tier 2, often on a much less carefully structured basis and on negotiable current market price points.
Nonwovens are expanding rapidly in the automotive sector as consumers demand greater comfort and safety, and automakers and their component suppliers seek to decrease costs by reducing the weight of vehicles, as well as lowering fuel consumption and CO₂ emissions.

Although woven and knitted fabrics continue to dominate the total amount of textiles used within the automotive sector, nonwovens are becoming increasingly attractive to designers owing to their low weight and lower cost, as well as other key advantages, such as sound insulation.

Nonwovens are employed in upholstery and headliners, moulded parts and insulation, carpet and floor mats, where needlepunched materials dominate. A wider selection of nonwovens is to be found in automotive filtration and belts, tubes and other high-performance components.

The use of natural fibre nonwovens – often as the reinforcing substrate in composite parts – is also increasing significantly.

More than 40 applications of nonwovens in vehicles have already been identified, from trunk liners and carpets to air and fuel filters (Table 5), and more new end-uses are being developed continually.

By building in essential properties necessary for good performance and safety, nonwovens can assist in reducing the weight of the vehicle, enhance comfort and aesthetics, and provide insulation, fire retardancy and resistance to water, fuels, extremes of temperature and abrasion.

According to EDANA, the international association for the nonwovens and related industries, nonwovens are easy to handle during vehicle assembly. They are tailor-made for their function and can be heat-formed, embossed, lined, coated and printed.

And owing to their versatility and numerous benefits they are also widely used in the design and construction of other vehicles and transportation means, such as aircraft, trains, boats, spacecraft and satellites.
Autoneum became a listed company in May 2011, when it was split from the Winterthur, Switzerland-headquartered Rieter Group.

As a global technology frontrunner in acoustic and thermal management solutions for vehicles, it is now a leading partner to the major light vehicle and heavy truck manufacturers worldwide, with a focus on cost-effective solutions for noise reduction and thermal management to increase vehicle comfort and value.

Of the company’s sales of CHF2.28bn in 2018, 43% were achieved in Europe, 41% in North America, 11% in Asia and 5% in South America, Middle East and Africa (SAMEA).

The company has a balanced spread of original equipment manufacturer (OEM) customers as shown in Table 11.

<table>
<thead>
<tr>
<th>Customer</th>
<th>Sales (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ford</td>
<td>15</td>
</tr>
<tr>
<td>BMW</td>
<td>12</td>
</tr>
<tr>
<td>Honda</td>
<td>11</td>
</tr>
<tr>
<td>Toyota</td>
<td>7</td>
</tr>
<tr>
<td>Mercedes-Benz</td>
<td>6</td>
</tr>
<tr>
<td>Nissan</td>
<td>6</td>
</tr>
<tr>
<td>Fiat Chrysler (FCA)</td>
<td>6</td>
</tr>
<tr>
<td>Volvo</td>
<td>6</td>
</tr>
<tr>
<td>Renault</td>
<td>6</td>
</tr>
<tr>
<td>General Motors</td>
<td>6</td>
</tr>
<tr>
<td>PSA Peugeot Citroën</td>
<td>5</td>
</tr>
<tr>
<td>Jaguar Land Rover</td>
<td>5</td>
</tr>
<tr>
<td>Volkswagen</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: Autoneum

Autoneum’s key products are now chiefly grouped into four areas: engine bay, interior floor, underbody and body treatment.

**Engine bay**

The heat storage in the engine bay achieved with encapsulations reduces fuel consumption at the next cold start, which in turn leads to lower vehicle emissions.
Donaldson

Donaldson Co Inc, 1400 West 94th Street, Bloomington, MN 55431, USA.
Tel: +1 952 887 3131. Fax: +1 952 887 3155. Web: www.donaldson.com

Donaldson is one of the largest users of nonwoven filter media and has regularly made bolt-on acquisitions throughout its 100-year history. Within the US$80bn filtration market, Donaldson’s target markets are within eight categories with a combined value of around US$35bn, but interestingly, the company does not directly compete in the conventional automotive filtration market, despite the use of its products in many other kinds of engine.

However, in specialising in filter media, and having pioneered the use of nanofibres, there is naturally plenty of spill-over, and Hollingsworth & Vose, for example, has a global patent licence to employ Donaldson Ultra-Web nanofibre media technology for use in filter media and filter elements for pleated air filters for on-road vehicle applications.

Donaldson achieved overall sales of US$2.73bn in its financial year to the end of July 2018.

In its latest annual report, Donaldson notes that expenditure on filter media constitutes 20% of its raw material costs.

The company’s cost of sales for the 2018 financial year is reported at more than US$1.8bn, of which raw materials accounted for 60-65%. This means Donaldson spends around US$210-230m on filter media annually. Further, the company reports that it buys its filter media from just two suppliers and works closely with them on the development of proprietary nonwoven processes and products.

In the year to July 2018, Donaldson committed US$55.5m to research and development (R&D) activities and has a global network of scientists and engineers, along with internal resources that include a corporate library, design verification centres, prototype capabilities and an advanced manufacturing technology group. The company plans to increase its R&D spend in the coming years.

Donaldson employed around 14,000 people at its worldwide operations as of 31 July 2018. Products are manufactured at 53 plants around the world.
Auria

Auria Solutions Ltd, Highway Point, Gorsey Lane, Coleshill, Birmingham B46 1JU, UK. Tel: +44 1675 464999. Web: www.auriasolutions.com

Auria Solutions is now the second largest global supplier of automotive acoustic and textile solutions, formed in 2017 as a joint venture between Shanghai Shenda (70% ownership) and IAC Group (30% ownership).

With financial headquarters in Coleshill, Birmingham, UK, and operational headquarters in Southfield, Michigan, USA, and Düsseldorf, Germany, Auria is built on a 150-year transportation industry heritage.

The company currently operates 27 manufacturing plants and four technical facilities in 10 countries, has interest in three joint ventures and employs nearly 7,000 people worldwide.

The company breaks down its product range into four key areas as shown in Table 32.

<table>
<thead>
<tr>
<th>Product area</th>
<th>Product</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acoustics</td>
<td>Dash insulators and absorbers, carbon fiber, vertical lapped fibre, mass back extrusion, foam in place and custom sheeting</td>
<td>Acoustic solutions block and absorb road noise and reduce engine noise in the interior</td>
</tr>
<tr>
<td>Flooring</td>
<td>Carpeted floors, utility flooring, accessory mats, tufted and nonwoven textiles, utility vacuum forming and compression moulding</td>
<td>The major trim feature and the carrier for a significant portion of the interior trim system</td>
</tr>
<tr>
<td>Fibre-based products</td>
<td>Trunk trim, package trays, acoustic mapping and lightweighting services</td>
<td>Comfort, style, safety and functionality for interiors</td>
</tr>
<tr>
<td>Aerodynamic</td>
<td>Wheel liners and underbody shields</td>
<td>Create streamlined airflow effect between the vehicle’s undercarriage and the road, resulting in reduced or eliminated low-pressure zones and drag on the vehicle</td>
</tr>
</tbody>
</table>

Source: Auria Solutions

Expansions in 2019

In February 2019, Auria opened its latest manufacturing plants in Vráble, Slovakia, and Wuhan, China.

The Slovakian plant will produce automotive flooring systems and fibre-based decorative trim components for Jaguar Land Rover and other premium original equipment manu-
# Glossary

**AA&E**  
Aunde Achter & Ebels

**A-B-C pillar**  
The A-pillar is a name applied by car stylists and enthusiasts to the shaft of material that supports the windshield (windscreen) on either of the windshield frame sides. By denoting this structural member as the A-pillar, and each successive vertical support after a successive letter in the alphabet (B-pillar, C-pillar, etc.), this naming scheme allows those interested in car design to have points of reference when discussing design elements. In the most usual configuration, the C-pillar supports the rear window.

**ABL**  
active buckle lifter

**ABS**  
anti-lock braking system; acrylonitrile butadiene styrene

**ACCC**  
Advanced Composite Center (Toray Industries)

**ACF**  
Advanced Carbon Fibers (SGL)

**ACR**  
active control retractor

**ACRS**  
air cushion restraint system

**ACU**  
airbag control unit

**AE**  
Automotive Experience (Johnson Controls)

**AFBG**  
Aramid Fibers Business Group (Teijin)
List of tables

Table 1: OEM shares in battery electric vehicle production, 2018 ......................................................8
Table 2: Leading Tier 1 companies with textile solutions, 2018 .............................................................9
Table 3: Estimated consumption of textiles in 91m cars and light vehicles ...........................................12
Table 4: Estimated value of textiles in 91m cars and light vehicles .........................................................13
Table 5: Some examples of where nonwovens are used in cars ..............................................................14
Table 6: Global production of cars and commercial vehicles, 2019 ........................................................24
Table 7: Key Chinese alliances of car manufacturers ..............................................................................25
Table 8: Examples of relevant Tier 1 company expansions in China since 2008 ........................................25
Table 9: Examples of Tier 1 investments in Eastern Europe since 2001 ....................................................27
Table 10: Key Tier 1 players in insulation, NVH materials and exterior textile parts ...............................29
Table 11: Autoneum, OEM customers, 2018 ............................................................................................33
Table 12: Autoneum, engine bay products ...............................................................................................34
Table 13: Autoneum, interior floor products ............................................................................................35
Table 14: Autoneum, underbody products ...............................................................................................36
Table 15: Autoneum, body treatment products .......................................................................................36
Table 16: Autoneum, financial performance, 2014-2019 ......................................................................37
Table 17: Key Tier 1 suppliers of automotive filtration products .............................................................41
Table 18: Donaldson, financial performance, 2014-2018 ......................................................................45
Table 19: Donaldson, significant recent acquisitions .............................................................................47
Table 20: Mann+Hummel, recent filter media introductions ..................................................................52
Table 21: Mann+Hummel, new mobility developments .........................................................................52
Table 22: Mann+Hummel, significant recent acquisition .......................................................................54
Table 23: Clarcor, acquisitions to 2016 ....................................................................................................56
Table 24: Toyobo: net sales by segment, 2015-2019 ..............................................................................61
Table 25: Toyobo: financial performance, 2015-2019 ......................................................................... 61
Table 26: Key Tier 1 players in carpet, interior trim and headliners ...................................................... 65
Table 27: Adler Pelzer, key products, 2019 ...............................................................................................68
Table 28: Adler Pelzer EVO package .....................................................................................................69
Table 29: Asahi Kasei, financial performance, 2014-2018 ...................................................................71
Table 30: Key Asahi Kasei products for the automotive industry ..........................................................72
Table 31: Notable Milliken innovations for Sage ..................................................................................73
Table 32: AURIA product range .............................................................................................................77
Table 33: Faurecia sales, percentage by customer, 2019 ...................................................................... 81
Table 34: Faurecia, sales by business unit, 2019 ....................................................................................82
Table 35: Faurecia, financial performance, 2014-2019 .......................................................................82
Table 36: Faurecia, expansion in China since 2004 .............................................................................83
Table 37: Faurecia, expansion in Eastern Europe since 2004 .................................................................84
Table 38: Faurecia, key natural fibre introductions ................................................................................85
Table 39: Freudenberg Group, financial performance, 2014-2018 ...................................................... 89
Table 40: Freudenberg Group, sales by business area, 2018 .................................................................90
Table 41: Freudenberg, sales by sector, 2018 .......................................................................................90
Table 42: Freudenberg, sales by geographical region, 2018 .................................................................90
Table 43: Freudenberg Filtration Technologies, notable developments, 2005-2014 .........................92
Table 44: Global development of the VIAM floor mats business .........................................................94
Table 45: Freudenberg energy storage developments .................................................................96
Table 46: Grupo Antolin, financial performance, 2014-2018 .........................................................97
Table 47: Grupo Antolin, sales by business, 2018 ......................................................................98
Table 48: Grupo Antolin, sales by region, 2018 .........................................................................98
Table 49: Grupo Antolin, one-step headliner accessories .............................................................100
Table 50: IAC, timeline for development in Europe .......................................................................103
Table 51: IAC, timeline for development in North America ..........................................................105
Table 52: IAC, timeline for development in China .........................................................................106
Table 53: IAC, timeline for development in Asia ..........................................................................107
Table 54: Teijin Group, financial performance, 2015-2019 ............................................................109
Table 55: Teijin, key activities of the materials business .................................................................110
Table 56: Teijin Frontier, examples of functional products .............................................................111
Table 57: Teijin, significant recent carbon composites activity ......................................................113
Table 58: Toray Industries, financial performance, 2015-2019 ......................................................115
Table 59: Toray Industries, key fibre and nonwoven brands .........................................................116
Table 60: Toray’s Carbon Fibres and Composites Business, significant developments .............118
Table 61: Toyota Boshoku, seat sales, 2015-2019 ..........................................................119
Table 62: Toyota Boshoku, financial performance 2015-2019 ......................................................120
Table 63: Toyota Boshoku, sales by region, 2014-2018 ..............................................................120
Table 64: Toyota Boshoku, timeline for kenaf product developments ........................................122
Table 65: Events leading up to the formation of YFAI .................................................................124
Table 66: Notable features of the Yanfeng XiM20 .........................................................................125
Table 67: Key Tier 2 suppliers ......................................................................................................129
Table 68: Ahlstrom, significant filter-media related acquisitions .................................................133
Table 69: Ahlstrom, significant filter-media related expansions ....................................................134
Table 70: AstenJohnson/Foss, products for the automotive industry ............................................139
Table 71: Avintiv, key acquisitions ..............................................................................................145
Table 72: Borgers, turnover, 2014-2018 .......................................................................................147
Table 73: Borgers, key products ....................................................................................................150
Table 74: DuPont, overview of services to the automotive industry .............................................155
Table 75: ELG Carbon Fibre, product range ..................................................................................163
Table 76: Fibertex, notable acquisitions, 2004-2019 .................................................................165
Table 77: Filtration Group, acquisitions from 2009 .....................................................................167
Table 78: Hollingsworth & Vose, recent product launches .........................................................178
Table 79: Janesville Acoustics, turnover, 2014-2018 ...............................................................179
Table 80: KAP Automotive Components, overview ....................................................................188
Table 81: Kasai Kogyo, turnover 2015-2019 ..............................................................................189
Table 82: Kolon Glotech, areas of focus for new materials .........................................................191
Table 83: Lydall, financial performance, 2014-2019 .................................................................193
Table 84: Lydall Performance Materials, recent products ..........................................................194
Table 85: Lydall Southern Felt, product range ............................................................................195
Table 86: Sandler, turnover, 2014-2018 ......................................................................................201
Table 87: Shawmut, key capabilities ...........................................................................................203
Table 88: Shawmut, summary of key lamination processes .........................................................205
Table 89: Comparison of existing and Soteria architectures .......................................................208
Table 90: Dreamweaver, current separator range ........................................................................209
Please send me more information about the following publications:

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