Sustainable mobility fuelled by nonwoven technology

By **Jens Kastner** 08 February 2018

Nonwovens researchers look to provide cleaner air in cars while reducing exhaust emissions, writes Jens Kastner, Poorna Rodrigo, Barbara Bierach, Julian Ryall and Sarah Gibbons.

The automotive sector is a hotbed of growth for industrial performance materials like nonwovens. And the global market for such materials has the potential to cross the €2bn mark soon, according to Germany-based Freudenberg Performance Materials. For that matter, the industrial performance materials market, led by nonwovens, has been growing by over 7% on average of late, according to Freudenberg data – and the gain is higher than the growth of global vehicle production.

The expense of electric cars means that automotive manufacturers are opting for cheaper material components, such as nonwovens

This growth is chiefly being driven by the automotive sector's worldwide efforts to substitute conventional materials, such as injection moulded parts, steel and heavy layers, with more lightweight performance material solutions, including nonwovens, to support a growing 'trend towards e-mobility', a company spokesperson tells WTiN.

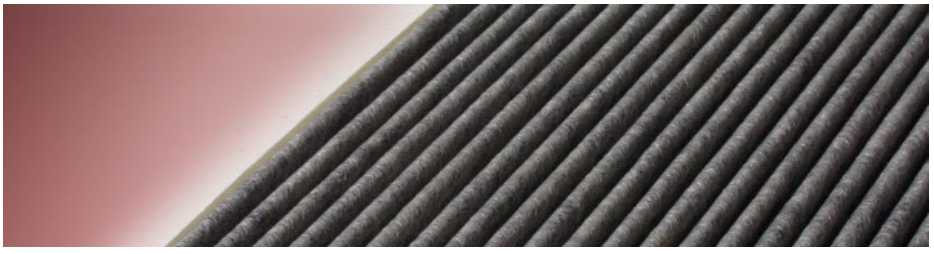
Unique qualities possessed by materials such as nonwovens has helped Freudenberg to develop innovative products. For example, the company uses what it calls its Lutraflor technology to offer a perfect nonwovens-based automotive carpet, insert mats, interior and trunk-lining solutions. The material based on recycled polyester has a high-quality appearance, an environmentally-friendly production process, and excellent formability.

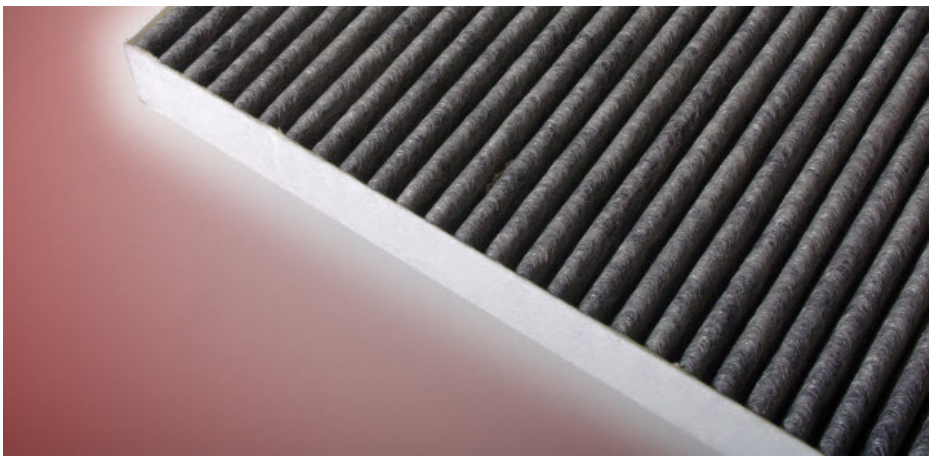
"Nonwovens are lighter than woven variants and therefore support a more economical driving style," the company spokesperson says. Besides, the technology has helped the company eliminate the use of latex and other chemical binders. "Compared to conventional automotive carpets, these nonwovens provide weight savings of up to 40%," the spokesperson adds.

Such nonwoven materials may find additional demand in future by being used to help make fuel cells – where hydrogen gas is used to power electric cars. Freudenberg has developed high-tech nonwovens that can be incorporated into fuel cells which are characterised by "excellent quality standards and exceptional functional flexibility," says the spokesperson. High thermal and electrical conductivity, optimum protection of the membrane against damage, and very good processing properties are just a few of the features that characterise these advanced nonwovens.

German innovation

Germany is certainly a key hub for innovation in automotive nonwovens, with the German car manufacturing industry looming hard at boosting its sustainability, according to Wolfgang Schilde, head of the Center of Excellence in Nonwovens, at the Sächsisches Textilforschungsinstitut (STFI - Textile Research Centre in Saxony) in Chemnitz. "Currently, it is all about making car components lighter, cheaper and recyclable," Schilde says.





Activated carbon automotive filters can boost ventilation performance

While the automotive sector is moving towards e-mobility, electric cars are still perceived as too expensive for the mass market, and as 85% of the cost in the production of cars are material costs, demand for cheaper components is on the rise. “BMW built its entire i3 car out of carbon, but not everything has to be made from carbon fibres,” says Schilde. He adds: “We are developing ways to create cheaper nonwovens based on glass-polypropylene composites, which are denser and less heavy than carbon and also less expensive.” With this goal in mind, last May, the Centre for Textile Lightweight Engineering within the STFI started operations in a new 1,500 sq m laboratory.

The second big issue is recycling. “Currently, manufacturers mainly recycle leftover nonwovens from the production process. The next step is to make nonwoven composites recyclable at the end of a car’s lifespan,” Schilde says. One idea is pyrolysis to retrieve the resin out of carbon composites and to use the remaining bare carbon fibre as raw material for new products – another research project in Chemnitz.

Gerhard Schöpping, Freudenberg Performance Materials’ director of global innovation and technology, explains that Freudenberg’s latest car interior materials, such as carpets, are made more sustainably and 30% lighter than before by using sorted, mono-material plastics made from recycled goods such as PET bottles. Also, typical knits superimposed on foam for car interiors, such as for ceilings, are being increasingly replaced by nonwovens. “Knits are regarded as luxury in car design, but nonwovens allow for more flexibility in the production process,” Schöpping says.

Another idea to make interiors more sustainable is by using natural fibres, with Germany’s TWE Group being an innovator here. Its subsidiary Isowood, for example, supplies car interior materials produced from 50% natural bast (stem) and 50% PP or PES bicomponent fibres. The product is cheaper than traditional plastic spray casts and boasts a superior robustness in crashes, even at temperatures below -20°C.

A key innovation is replacing stitched-in copper wiring in car seats with conductive nonwovens, says Willi Lauk, business unit director, automotive, at TWE. “The move towards e-mobility is about saving as much energy as possible. Heating an entire car cockpit draws too much juice from the battery.” The answer is to just heat the space around the driver via car seats or door interiors.

Looking ahead, nonwovens are also being eyed for use in external parts, for example, as underbody shields. Freudenberg achieves this to reduce noise and enhance aerodynamics. “Consumers today want less noisy cars,” Schöpping says. “Exchanging ejection moulding components or glass fibre with nonwovens not only reduces driving noises, but can make an underbody shield about 40% lighter,” Schöpping adds.

Another focus area is batteries, specifically the permeable membranes or separators made from nonwovens, which are placed between the battery’s anode and cathode points. STFI's Schilde is in the middle of a research project to get separators that are currently 150 to 200µ thick, down to a thickness of 50µ to pack more battery power in less space and thus give e-cars a wider range.

A big issue with batteries for e-mobility is their thermal instability. Meltdowns, explosions and fire are a well-known phenomenon. Freudenberg, therefore, is developing separators from ceramic-coated nonwovens with high thermal stability and electrical conductivity, for optimum protection of the membrane against damage. “The next big innovation will be propulsion by fuel cell technology,” Schöpping says. “Freudenberg is one of the few manufacturers worldwide with the industrial capacity to produce gas diffusion layers (GDL) for fuel cell propulsion.”

Asian automotives

Asian automakers, of course, also have a reputation for innovation and they have also been developing nonwovens for use in automotive design. Amid ever-increasing interest by Asian consumers in improving the quality of air in their often-polluted cities, South Korean researchers have announced two breakthroughs in the use of nonwovens in high-performance air-conditioning filters for vehicles.

One example is a filter made by strong-adsorbing activated carbon on a nonwoven fabric, which was jointly unveiled by the Korea Institute of Industrial Technology (KITECH) and Seoul-based Ecopro Co, a producer of battery materials and chemical filters, in May 2017.

KITECH Technical Textile & Materials R&D group researcher Sang Young Yeo claims the new technology is superior to the conventional way of heat-treating the fabric to apply the carbon. This is because heat treatment can cause the pores of the nonwoven fabric to be clogged, so ventilation performance drops to an extent that it becomes difficult to meet the needs of the automotive industry.

On the other hand, reducing the amount of activated carbon makes it difficult to filter harmful substances properly, with the chemical binding process that helps bond and fix activated carbon also being a problem through the reliance on harmful ethylene-vinyl acetate.

The research team solved the problem by using two types of nonwoven fabrics with melting points of 100°C and 260°C at the same time.

The activated carbon is fixed by melting only a part of the nonwoven fabric with heat of 100°C or more, while the other part remains unexposed to heat and therefore maintains full porosity. By using polyester as a binder, the material’s chemical harm is greatly reduced.

Another development recently unveiled in South Korea was a technology that can coat aluminium nanostructures onto a general nonwoven filter, so that it can simultaneously remove fine dust and bio-harmful substances with high efficiency by creating a strong electric field.

Developed by the Korea Institute of Materials Science (KIMS), this technology overcomes the drawback of conventional fine dust fi[illegible]ns that, with very small pore size and very dense fibres, have too much pressure loss, causing excess power use, consumption and vibration p[illegible]

KIMS Powder & Ceramics Division researcher Hye Moon Lee and his team are applying for domestic and international patents and conducting prototyping for automotive fine dust removers.

Meanwhile, Japan’s automakers and their suppliers are proving similarly innovative with regards to nonwoven materials. Chemical supplier Asahi Kasei has announced plans to market, on a trial basis, a new plant-derived nonwoven material that is both renewable and more environmentally-friendly than petroleum-based products. It will commence trial production later this year and intends to start mass production of this cellulose nanofibre (CNF) in late 2020.

Described as ‘post-carbon fibre’, CNF is made from cellulose, which makes up the cell walls of plants and gives them strength. Asahi Kasei envisages the light and tough, as well as environmentally-friendly, material will be used for bodies of next-generation vehicles and is already working with Japanese auto firms on applications.

The company is spending several hundred million yen on a trial production line at an existing plant in Miyazaki Prefecture, in South-West Japan, Kyushu island, and has developed equipment to mass-produce a sheet of nonwoven fabric that is one metre wide and can be shipped in rolls.

Island, and has developed equipment to mass-produce a sheet of nonwoven fabric that is one metre-wide and can be shipped in rolls.

The Japanese government has recognised the potential of CNF, which is essentially produced by pulping plant fibres to a nano level some 10,000 times thinner than a human hair and fabricating the output into fibres that are five times stronger than iron but one-fifth its weight. The government is promoting research into the material and is anticipating Japanese manufacturers will generate annual sales of JPY1 trillion (US$9.05bn) of the product by 2030.

Osaka-based advanced fibre company Teijin Ltd is also making advances in the auto sector, with the vertically-oriented nonwoven structure of its V-Lap polyester material, which absorbs sound when used as the floor carpet in the Mitsubishi Outlander, yet weighs only half as much as other materials used for this purpose. V-Lap has also been developed for use in vehicle ceilings and doors.

Teijin also produces Unisel, a filament nonwoven fabric produced through a combination of three manufacturing methods — multi-layering and stretch-expanding; burst fibre; and tow opening. As a result, Unisel can be easily heat-sealed – enabling clear printing – and can be moulded, while the porous microstructure of the fibres results in high oil adsorption and heat retention.

The company also produces the ultra-fine, three-dimensional nonwoven fabric Cordley, which has 1/1,000 denier threads to ensure maximum breathability, and is used for steering wheel covers, while research is also underway on the use of nonwoven PET as a coating in future generations of engines that utilise lithium ion batteries.

Stateside solutions

Finally, showing just how global this trend is, US nonwovens innovators also continue to target the automotive sector. Nonwovens industry association INDA said that the consumption by tonnage of nonwoven materials for transportation markets increased 19.6% annually from 2011 to 2016. And given market researchers Euromonitor put the value of the overall US nonwovens market at US$4.5bn in 2016, this is significant.

“Automakers set a North American production record (in 2016) as 17.9 million light vehicles [cars and vans] poured off assembly lines in the US, Mexico and Canada,” says a spokesman for INDA. This is a big market and “the use of nonwovens in the auto sector is expected to grow further in the future. There is still plenty of opportunity as new platforms introduce new products and materials. More vehicle sales of larger vehicles are being produced in North America with an increasing amount of nonwoven material.”

Innovators are responding. North Carolina-based Tenowo has launched its cutting-edge seat nonwoven material into the US market after its German headquarters successfully introduced it in Europe. The material, Multiknit, made from recyclable PET plastic bottles has replaced traditional foam providing cushioning in car seats.

The mechanically bonded fibres include no chemicals and do not carry the same VOCs risk as foam. It has higher air permeability than foam, thus helping curb emissions as less engine power is required to drive the air through the cushion.

“Price is king in the US car industry,” says Tenowo automotive sales manager Marvic Mendez. “Our material is comparative with foam in that regard.”

Available in thickness of 2-6 mm, weighing from 120-400 g per sq m, the flexible material is already being used in Mercedes, BMW and Audi models, and is being offered to the Japanese and South Korean-owned manufacturers in the US.

Tenowo is also working with Tesla on its new models to use Multiknit in its electric self-drive cars. “That will be very big for us,” Mr Mendez says. “Our first American OEM with the car of the future.”

Tesla Model 3 also includes a huge high-efficiency particulate air (HEPA) nonwoven filter. “Just as we've designed Model S and Model X to avoid collisions or protect their occupants when one happens, we felt compelled to protect them against the statistically more relevant hazard of air pollution,” a spokesman says. “Inspired by the air filtration systems used in hospitals, clean rooms, and the space industry, we developed a HEPA filtration system capable of stripping the outside air of pollen, bacteria and pollution before they enter the cabin and systematically scrubbing the air inside the cabin to eliminate any trace of these particles. The end result is a filtration system hundreds of times more efficient than standard automotive filters, capable of providing the driver and passengers with the best possible cabin air quality no matter what is happening in the environment around them.”

Acoustics and in-cabin comfort have also been a focus of South Carolina-based performance materials company, Milliken. “Acoustics is a huge trend driving new products as everyone wants quieter cabins,” says marketing manager Meg Ried, who added that the use of nonwovens on vehicle exterior applications was “an exciting new space” for the company. Underbody shields and wheel wells, traditionally plastic, are now being designed with nonwovens by Milliken.

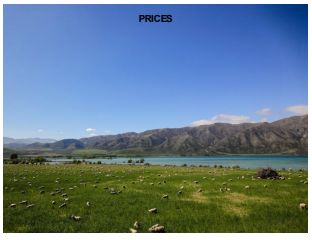
“While ice typically attaches itself to plastic on the underside of a vehicle, it now detaches from this ‘Travel Tough’ material,” says Ried, explaining that it reduces moisture absorption by up to six times as much as its traditional counterparts.

Have your say. Tweet and follow us @WTiNcomment
(https://twitter.com/WTiNcomment)

 Print

RELATED ARTICLES

SA wool market 3.1% higher amid supply concerns (/article/2018/february/050218/sa-wool-market-31-higher-amid-supply-concerns/)
Jonathan Dyson | WTiN



Combined NZ wool sale sees mixed results (/article/2018/february/050218/combined-nz-wool-sale-sees-mixed-results/)
Jonathan Dyson | WTiN

EMI returns to record high as market rebounds (/article/2018/february/050218/emi-returns-to-record-high-as-market-rebounds/)
Jonathan Dyson | WTiN

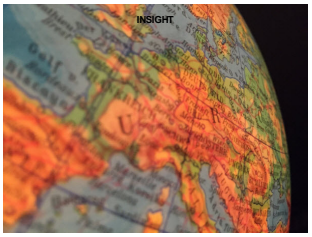
PRICES

NCWSBA Australian Wool Market Report (/article/wilcox-archive/2018/february/9218/)

PRICES

Rare and speciality fibres prices monthly round-up – January 2018 (/article/2018/february/050218/rare-and-speciality-fibres-prices-monthly-round-up—-january-2018/)

TRENDING

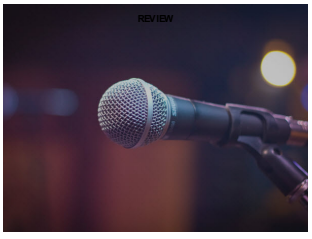


Outlook for digital textile printing in 2018 (/article/2018/february/050218/outlook-for-digital-textile-printing-in-2018/)

By Tansy Fall | WTiN

International markets crucial for Moroccan digital textile printing (/article/2018/january/290118/international-markets-crucial-for-moroccan-digital-textile-printing/)

By Madelaine Cornf… | WTiN



European Digital Textile Conference forecasts strong growth (/article/2018/january/150118/european-digital-textile-conference-forecasts-strong-growth/)

By Joe Link | WTiN

Automated pretreatment capabilities from Schulze (/article/2018/january/150118/automated-pretreatment-capabilities-from-schulze/)

By Madelaine Cornf… | WTiN

Schoeller makes electrically heated clothing a reality (/article/2018/january/150118/schoeller-makes-electrically-heated-clothing-a-reality/)

By Fiona Haran | WTiN

BOOKMARKS

No articles bookmarked!