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Our quality promise to plastics processors

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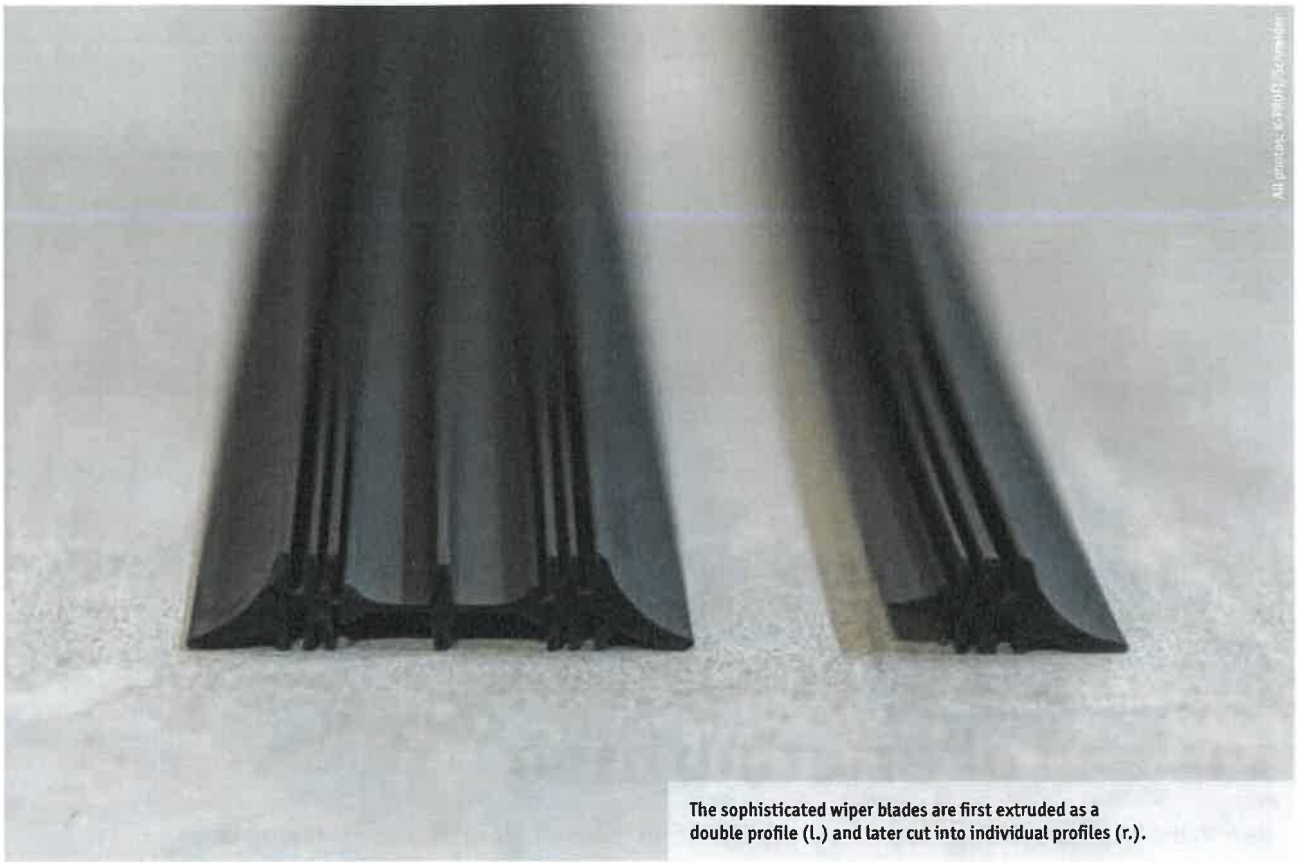
Parat produces exterior and interior components for commercial vehicles and caravans by injection moulding and thermoforming, among other processes. CEO Frank Peters shows the way:

Maxi formats with Class-A surface

How **Südpack** and **Vorwerk** turn film remnants into hoover parts. How **APD Schlauchtechnik** adds liquid additives. How **Valeo** cleans vulcanisation exhaust air with electrostatic filters. How **Re-PET** is opening up strapping. And where bionic vacuums from **ClingTech Bionics** are good for.



All photos: © PROFI Schneider

The sophisticated wiper blades are first extruded as a double profile (l.) and later cut into individual profiles (r.).

Michaela Hauptlorenz is responsible for all engineering in rubber processing at Valeo Wischersysteme.

Milan Wlömer (KMA Umwelttechnik): "With our modular systems, we take the respective process and exhaust air into account."

Electrostatic precipitator instead of afterburning

How Valeo Wischersysteme clean their vulcanisation exhaust air in an energy-saving way

Often, post-combustion is used to clean exhaust air such as that produced during rubber extrusion with subsequent heat treatment. Due to the high temperatures required, this is associated with a high energy consumption and CO_2 footprint. Valeo Wischersysteme GmbH in Bietigheim-Bissingen has therefore taken a new approach with an electrostatic precipitator system.

Text: Dipl.-Chem. Toralf Gabler, Editor K-PROFI

The French automotive supplier Valeo, which with annual sales of 17 billion euros is one of the top 10 in the world, has 16 production and development sites with 8,800 employees in Germany alone. German customers, which mainly include the major OEMs, account for about 30 % of the group's worldwide turnover. Andreas vom Bruch, Director Communications Germany, sees two megatopics in which Valeo is on the move: "Firstly, electrification from the powertrain via e-motors to climate management, and secondly, autonomous driving with corresponding sensor technology and driving assistance systems."

Around 850 employees work at the Bietigheim-Bissingen site. In addition to front-end modules for the climate management of vehicles, complete wiper and washer systems for the front and rear areas are produced here. The wiper blades for these systems are produced in-house by Valeo Wischersysteme GmbH because the rubber parts, which are inconspicuous at first glance, have their work cut out for them. Under high contact pressure on the curved windscreen, they have to withstand more than half a million wiping cycles - corresponding to a distance of up to 900 km - as far as possible without wear. The dirt mixture on the windscreen and various cleaning agents require both high mechanical and chemical resistance. And when the wiper starts to move backwards after each wiping cycle, the wiping edge of the profile tilts over a tilting bar, which is an enormous dynamic load for the elastic material. All this places special demands on design, compound development and production.

Extrusion has replaced injection moulding

Because of the required accuracy, injection moulding was considered the manufacturing process of choice for a long time. "Until the end of 2022, we also still had injection moulding production here," reports Michaela Hauptlorenz, responsible for all engineering in rubber processing at Valeo Wischersysteme. Today, the profiles are produced here exclusively on two extrusion lines, which is more effective, but also places very special demands on the rubber compounds as well as the precision during production.

Since a wiper blade often consists of two different rubber compounds, the profile is produced in a coextrusion process. It is also extruded as a double profile with a centre strip. After vulcanisation in a salt bath, the profile strand goes inline for surface treatment, e.g. plasma/painting. The profiles are punched to the appropriate length of a wiper blade. The double profile is then cut lengthwise into two individual profiles with the centre strip removed. "Achieving the required precision with an elastic material is anything but trivial," emphasises Michaela Hauptlorenz. The special know-how for this was developed in Bietigheim-Bissingen and the machines were built in-house.

The individual modules for exhaust air purification are arranged one above the other and thus require little floor space.

For quality assurance, the geometry and surface of the profile strand are continuously monitored by control systems at several production stages - e.g. after vulcanisation and surface treatment. "This information is collated, and the sections detected as defective are automatically sorted out at the very end at the punching machine," explains Michaela Hauptlorenz.

Alternative exhaust air purification for new extrusion line

The engineering manager is particularly sought after when it comes to investing in new technology. When a new extrusion line was planned in 2019, the contract was awarded to the mechanical engineering company Rubicon from Halle/Saale, which installed the salt bath vulcanisation in addition to the extrusion technology. "The 30-metre vulcanisation line is equipped with a salt recycling system. This filters the salt from the washing cascade and returns it directly to the salt bath in a closed circuit," Michaela Hauptlorenz explains the resource-saving process. "In addition, the gas heating is equipped with an indirect ceramic burner system, which results in lower emissions."

Rubicon also recommended an alternative exhaust air purification technology from KMA Umwelttechnik in Königswinter. "In the vulcanisation tunnel, a gaseous mixture of, for example, decomposition products from the vulcanisation process and plasticiser vapours is produced at temperatures between 180 and 220 °C," Michaela Hauptlorenz knows. A common method for cleaning this exhaust air is thermal post-combustion with operating temperatures ≥750 °C. The method is established, reliable and low-maintenance; depending on the load of the exhaust air, the gas consumption and CO_2 emissions are correspondingly high. The mechanical engineering company from Halle, which had been working with KMA for a long time and had already realised several projects, therefore suggested an electrostatic precipitator system that would enable a reduction in CO_2 emissions and operating costs compared to afterburning.

Significant savings potential

Based on various parameters, exemplary operating cost comparisons as well as the level of CO_2 emissions can be calculated, which reveal clear savings potentials. "With an exemplary exhaust air volume of 5,000 m³/h, an afterburning system causes 525 tonnes of CO_2 emissions per year, while the electrostatic precipitator system causes only 12 tonnes. At current gas prices and the current CO_2 tax, operating costs of 4,800 euros with the KMA technology are thus compared to around 250,000 euros with the afterburning system - that is a saving of 98 %. Even a regenerative afterburning system (RTO) requires ten times as much energy as our environmental technology," says Friederike Schmedding from KMA Business Development, highlighting the significant difference.

For many companies, she says, it is an additional incentive that KMA filters are generally covered by the federal subsidy for energy and resource efficiency in industry (Module 4). "The conditions and the application process have just been improved once again," Schmedding emphasises. "Companies are allowed to start implementing the measure immediately after submitting the application at their own financial risk." This often avoids months of waiting. "The funding cap for SMEs has been raised to 900 euros per tonne of CO_2 saved. SMEs thus benefit from funding of up to 40 % of the investment costs. The funding possibilities of a specific project and the requirements of the funding provider are determined together at an early stage. It is also important to consider the payback period of the entire project."

Ready to try something new

"We didn't know this technology until then. But since KMA had a good reputation in the industry and we trusted Rubicon's know-how, we were willing to try something new," Michaela Hauptlorenz recalls. The good cooperation with Rubicon and KMA made it easy to get there. "The process was very satisfactory for us. We didn't have to delve deeply into the topic first, but defined our requirements, according to which the concept was designed and implemented," sums up the technology manager.

"Whereas in the past we often realised project-related, customised solutions, today we mainly offer modular systems that take into account the respective process and exhaust air," explains Milan Wlömer from R&D at KMA. "This means we are much faster in project planning, and with the existing modular system we can meet a wide variety of requirements." Therefore, the plant manufacturer is on the move with its energy-saving exhaust air purification systems in various segments from the textile to the food industry to metal processing. But numerous systems are already in operation in the plastics and rubber industries as well. Customers include rubber processors such as Kraiburg, M+S Silicon or Saargummi, but also film extrusion at Mondi or compounding at Ems-Chemie.

Precise adaptation through modular design

The filter system installed at Valeo contains a double-stage air-water heat exchanger, an electrostatic precipitator, a UV light module and a catalytic carbon filter. A fan at the outlet of the system draws the exhaust air through all these modules. The flow-optimised design of the electrostatic precipitator, which allows the air to pass almost unhindered, contributes to the energy efficiency of the KMA technology. The exhaust air extracted from the vulcanisation tunnel as well as the burner arrives at a temperature of 140 to 170 °C. The air is cooled down in the first step. To cool it down, hall air is added in the first step. It is then cooled further in the heat exchanger to about 60 °C. "At this temperature, the electrostatic precipitator has a very good efficiency in relation to the cooling used," Milan Wlömer knows. "Many gaseous residues in the exhaust air then condense into an aerosol, which enables their separation."

Heat exchanger recovers energy

When the air is cooled, the heat exchanger heats water flowing through it from about 20 to about 60 °C. "By using this recovered energy, owners of our systems can achieve additional savings," emphasises Friederike Schmedding, "because this comes in addition to the energy balance." Milan Wlömer knows of numerous implemented possibilities, from complete hall or office heating systems to recycling this energy into technical processes. "If higher temperatures are required for further use, other media can be used instead of water. With glycol, for example, up to 150 °C is possible."

"In view of energy prices, such uses to increase energy efficiency are currently very much in demand, but they must always be well thought out and take into account the mutual dependencies of processes," Wlömer makes clear. "On the one hand, the energy must always be available or available exactly when it is needed. Some users solve this by using a buffer tank with the heated medium. On the other hand, an alternative must be available when the energy is not needed, such as for heating a building in the summer. In the meantime, we can contribute extensive experience from numerous projects."

At Valeo Wischersysteme, the water is currently simply cooled by an air cooler, because before it is actually used, the new exhaust air system should first prove its suitability in everyday work. "After more than a year of operation, we are confident of its suitability and are therefore working on a concept to use the waste heat to preheat the supply air for the paint shops in the future," reports Michaela Hauptlorenz. "That would be a very good fit, because the supply and return temperatures of the cooling circuit of the heat exchanger on the exhaust air system have the same temperature level as the supply and return of the supply air heater," adds Milan Wlömer.

Electrostatic filter and UV light ensure clean air

After the heat exchanger, the exhaust air flows through an electrostatic precipitator – the heart of the system. In electric fields generated by high voltage, the particles contained in the air first receive an electric charge at profile ionisers. The charged particles are then forced against the earthed collector plates and held in place. According to KMA, the separation efficiency is at least 95 %. Liquid components drip off and collect in a bottom trough, while sticky and viscous substances initially remain on the plates.

Michaela Hauptlorenz (Valeo) and Milan Wlömer (KMA Umwelttechnik) in front of the exhaust air purification system.

The exhaust air is extracted at several points above the salt bath vulcanisation system.

Every hour, 4,780 m³ of exhaust air flows through the electrostatic filter module of the Ultravent M series, which is designed for a throughput of 5,000 m³/h. "For higher throughputs of up to 20,000 m³/h, several modules are simply arranged in parallel," Milan Wlömer explains. "There are also technical solutions for smaller and even higher flow rates."

Subsequently, further volatile components are rendered harmless in the downstream UV light module. For this purpose, UV radiation with a wavelength of 185 nm generates highly reactive ozone, and UV light with a wavelength of 254 nm directly attacks long-chain hydrocarbons. A subsequent activated carbon filter breaks down excess ozone before the now clean air is led outdoors via the hall roof. The modules are arranged one above the other, so that the area required by the system, which is several metres high, is relatively small.

Automatic filter cleaning simplifies maintenance

"We definitely had reservations about replacing a proven technology with one that was new to us," admits Michaela Hauptlorenz. "The afterburning system is very robust and only needs maintenance once a year. With the electrostatic precipitator, we didn't know how heavy the workload would be for the maintenance staff on the line." Despite training, they would also have had to first gain their experience of how to interpret certain process parameters of the new plant in each case. "But," concludes the technical manager, "it works well." She sees a great relief in the automatic cleaning. This is another reason why the technology has been well accepted by the staff.

Milan Wlömer knows the reservations about conventional electrostatic filters. "Maintenance is often time-consuming because they have to be cleaned frequently and removed in the process." To get around this, KMA has developed an automatic cleaning system. For this purpose, the system is flushed with warm water and a cleaning agent when the air supply and exhaust are closed. "Nothing has to be removed, everything runs automatically at a programmed time," Wlömer points out. The wash water can be used several times, depending on the degree of soiling. At Valeo Wischersysteme, it is used for two rinsing processes and then collected in an IBC container next to the system. A service provider takes care of the disposal of the water, which contains the substances filtered from the exhaust air. "This is completely uncomplicated for us," says Michaela Hauptlorenz. "We have an established disposal system here, to which a relatively small amount is now added."

Since the filter system cannot be in operation during cleaning, this is carried out once a week during the obligatory maintenance shift of the entire extrusion line. So there is no additional production downtime as a result. "In the case of production lines that must run continuously, it is possible to switch to a second filter system as an alternative, if one is available," Milan Wlömer explains. It is also possible to discharge the exhaust air unfiltered via a bypass during cleaning. "Of course, only if this is allowed or if an approved malfunction mode is permitted," the expert emphasises.

Goal: carbon neutrality by 2050

Following the overall positive experience, Bietigheim-Bissingen is now looking into converting the second extrusion line from post-combustion to an electrostatic precipitator system as well. "So far we are working out the basics. In the process, we are also planning to use the recovered energy at the same time," reports Michaela Hauptlorenz. In addition, another system is already in operation at a Valeo plant in Mexico.

"All this fits in well with our Group strategy, according to which we want to have implemented carbon neutrality by 2050," Andreas vom Bruch affirms. Already by 2030, CO_2 emissions are to be reduced by 45 % compared to 2019 across the entire value chain. Ten years ago, Valeo started with sustainability goals on its own initiative, but in the meantime, this is increasingly demanded by customers, says the Valeo Germany spokesperson.

For this reason, the Bietigheim-Bissingen site is also active in many areas. For example, production and administration are being converted to LED lights. The expansion of photovoltaics on two production buildings is planned, as well as the use of heat pumps instead of pure cooling systems. In addition, harmonic voltage recovery is planned, whereby unused electricity voltage peaks are stored and used when needed. This should reduce electricity consumption by about 10 %.

www.valeo.de
www.kma-filter.de
www.rubicon-halle.de

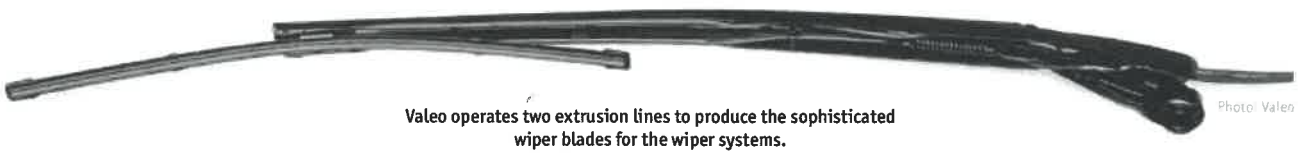


Photo: Valeo

Valeo operates two extrusion lines to produce the sophisticated wiper blades for the wiper systems.