

TPV changes window sealing game

For the last 10 years proponents have claimed TPES (thermoplastic elastomers) will replace rubber in automotive door seals, but there has been little progress. Now, however, the Skoda Superb has a full window system using TPVs (thermoplastic vulcanizates) fitted and it has opened the door to more applications at VW.

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Skoda's Superb sports a new window construction from TPV

A new project model led by materials supplier Sarlink has opened the way to wide acceptance of TPV window and door seals in mass-market cars. The project model is based around materials suppliers, bringing together processors, equipment suppliers and reporting to the car makers to develop systems which deliver lower weight, lower system cost and greater ease of assembly.

Up to now the seal manufacturers have owned the application and when the OE car makers have sought new materials, some have told their

customers that technical limitations of TPE materials – such as compression set – make these materials inappropriate for high-end or dynamic applications.

The TPV people argue – increasingly successfully – that when a seal relies only on material properties, then compression set is important and admit that their materials don't function as well as thermoset rubber in this respect.

However, the killer argument in favour of TPV materials is that advanced design techniques such as hinges and carefully designed deformation zones permit the newer materials to deliver the necessary sealing performance, while saving weight and cost and bringing other benefits such as uniform colour, faster assembly and more design flexibility.

According to Ed Deckers, Sarlink's sales director for Europe, the engineers at Sarlink have been working on this project for around nine years and have now got to the point where they can deliver a full glazing system using combinations of polypropylene, TPV and other materials. This is now in service on the Skoda Superb, launched around a year ago, and Sarlink is in advanced discussions with VW to use the same approach on other vehicles.

Specific grades of each material are selected for each functional area of the assembly, delivering stiffness and strength where needed, or softness and flexibility in other places. Altogether, said Deckers the assembly uses around eight different grades of TPV, as well as more different grades of polypropylene. Because all these material families are compatible with each other, joins are made

simply by melting the materials together without the need for adhesives.

It is not just about using softer grades near the edges to be sealed and harder grades to clip the seal to the metal bodywork. The design is also engineered with hinges, foams and hollow sections to deliver effective seal performance in door apertures, glass run channels and other areas.

Furthermore, TPVs are processed at relatively low temperatures and pressures compared with EPDM seals. This means it is relatively easy to co-mould the seals and the glass at the same time, further improving efficiency and quality.

Yet another benefit is that flocking and low-friction coatings can be applied direct from an extruder. A further benefit is visual appearance. Since all the materials are compatible and processed in the same way, the surface finish is similar from one element of the assembly to the next. Historically it has been hard to match the surface appearance of EPDM profile with a TPV waist-line seal.

Technical performance aside, the major change in process is that the materials supplier has developed the skills to generate effective sealing performance using a material which does not have the same elastomeric characteristics as soft EPDM extrusions.

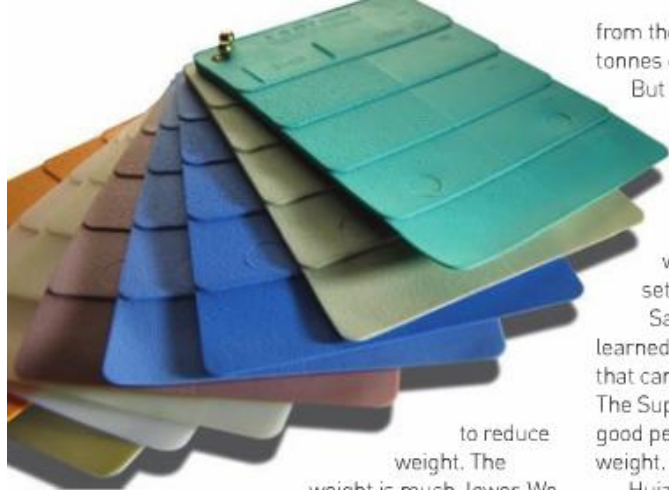
Dave Huizing, head of Sarlink said the traditional suppliers of seals and extrusions, "have the expertise and the know-how, but only as applied to EPDM, not to TPV. They are not driving this. It is the OEMs and VW who are driving this.

For VW, he said, "it is aesthetics – how does the seal look? Because this is a visible part on the car. You want one surface finish, matched up so that you do not notice [the joins]." With

Sarlink, he said, you can get one colour one texture all the same."

He said other factors are reduced weight and ease of assembly. "They want





to reduce weight. The weight is much lower. We can work to closer tolerances. In EPDM you have to create the functionality out of the mass. The third element is that this is much easier to mount on the car, it is not five or six sections which need to go together, but one big module which can be put on the car."

Huizing said the project began around nine years ago and the company has been steadily developing the expertise and the techniques needed to create a full module. These skills, he added are completely different from anything either in the car industry or the rubber industry.

"We had to do this because the traditional seal suppliers do not want to drive this. Their whole industry is based on EPDM. That is how their whole production equipment is set up, so they have a big installed factory base which is geared up to the other way of doing things and different materials"

Huizing said EPDM suppliers deliver bales of rubber to their customers and the customers process it and add value through their own designs, expertise and knowledge.

"The processors," he said, "had no experience of all the steps needed to convert a bag of thermoplastic pellets into an effective seal, so they would not take responsibility for actually making the change happen."

"What you often see," he said, "is that the established players say it is not needed, or it does not work. 'Also,' he continued, 'there is a clash between ourselves who promote these solutions, and the established EPDM world. The driver, he concluded, 'is definitely not that seal maker in between.'"

By doing this, he said, "they put themselves into a position where these things are being developed [by other people], and VW and BMW and all those other car makers say they want the solutions." By resisting the change, said Huizing, those processors lose the technology lead and become followers. "They rely on people like us to do the development, and they become only manufacturers, competing mostly on price."

Sarlink said the knowledge required to process a thermoplastic material has fallen on the materials supplier.

"It is pushed back to the material supplier, to us," said Huizing. That is a fundamental difference compared to the past. I believe this is how a quality TPV supplier differentiates itself

from the others. It is not about selling a few tonnes of material, and then letting them use it.

But about having the expertise or developing the expertise needed to help the customer make effective use of the properties of this material."

That, said Huizing, "is a fundamental shift of who is doing the work in the value chain and this is what sets us apart from other players."

Sarlink worked on the Skoda Octavia and learned about lifetime performance and how that can be managed through careful design. The Superb model builds on that, and delivers good performance at reduced cost and reduced weight.

Huizing said Sarlink is now talking in depth to VW to put the system into VW-brand models, as opposed to Skoda brand, and also to high-end car makers for whom reputation and quality are over-riding issues. He mentioned VW and BMW by name.

Deckers said the project team is lead by Sarlink, who work with the OEM on the project



and Sarlink brings in partners who can advise on manufacture and on process and equipment.

This is radically different from the traditional project model, where a processor will usually take the lead, bringing in process and materials expertise where necessary.

10-year development model

Around 2000, said Deckers, VW came to us seeking an alternative to rubber. They wanted to use something else to get better system cost and lower weight.

Deckers said VW went to the material suppliers – the EPDM suppliers – and the word got through to the Sarlink group, who had already done some work in this area.

VW was using the Skoda Octavia as a test platform. The company wanted to develop something new, but was not prepared to put it on a VW branded car, as the VW brand is seen as a premium brand and the company did not want to risk a technical failure on their flagship brand.

On the other hand a Skoda is a mid- to low-end brand and the Octavia was at the lower end of the Skoda range, so it was not so sensitive to failures emerging a few years into the life of the vehicle.

The concept has been developing with each new incarnation of the Octavia model. Deckers said Sarlink has been on the previous two generations of the Octavia model, with progressively more complex systems. The most recent Octavia had the most complex system to date, prior to the Superb.

While the Superb is still a Skoda brand, it is at the top end of the Skoda range, so VW clearly had confidence that the concept would work effectively over the lifetime of the vehicle.

Deckers said, "We were in Octavia, but this is a whole different concept as we have learned in the last 8 – 9 years how the material behaves in service."

He said the first step was to build a computer model and then to select materials. This he said is not simple, "it is not the choice of one material, but 35 shore A Sarlink or 50 shore A or 60 shore A or 75 depending on the function of this, and a PP, which might be natural or glass-filled."

He said the traditional rubber industry looks mainly to the softness of the material and the processing speeds. In this case, however, it is also looking at the design of the seal. To deliver effective sealing, the system employs hinges and other design tricks which compensate for the limitations on compression set and other parameters. These require specific grades to deliver a 10-year life-span.

High polymer content

Where a typical EPDM profile might have 25 percent EPDM polymer content, a top-quality soft TPV might have 75 percent EPDM polymer content.

The TPV is a special material composed of vulcanised EPDM and polypropylene. Softer grades use higher percentages of EPDM, while harder grades use more PP. All the growth and much of the value is in softer grades, noted Huizing.

So a soft grade starts out as 75 EPDM:25 PP. When the two materials are first mixed together, the uncured EPDM is the continuous phase, enveloping smaller particles of PP.

During processing the EPDM is cured and then something strange happens, the material undergoes a phase inversion. This means the discrete particles of PP merge together into a continuous phase, coating the small, discrete particles of cured EPDM.

Once this happens, the material is finished and can be prepared into pellets for delivery to the customer.

However, the processing of the ingredients is critical, as is the precise choice of polymers used as ingredients.

According to Deckers, each grade of Sarlink uses very precisely selected grades of EPDM. By having a very close relationship with its supplier of EPDM, Sarlink can deliver tightly controlled performance from its range of Sarlink products. ■

