Efficient **stabilizers** prevent emissions for **interior plastics**

By: Nick Palmen

Plastics in car interiors help reduce the weight of vehicles, allow new design options and enhance cost versus performance. Today, plastics are being used for an ever-increasing number of components inside cars, for example dashboards, head panels and upholstery. The main types are polypropylene (PP), polyurethane (PUR) and polyvinyl chloride (PVC).

Given the extreme conditions of heat and light inside vehicles, the plastics used need to be exceptionally resistant. But, plastics are not inherently stable. To prevent damage caused by prolonged exposure to heat and light they need to be treated. PP compounds for automotive interior parts require various properties, including mechanical and thermal stability.

Thomas Schmutz, Leader Technical Service & Application Development at SONGWON Industrial Group.

Emissions from PP are also the focus of increasing attention. In automotive interior applications especially, emissions can result from deficient polyolefin quality, i.e., impurities, and from degradation. Further causes relate to the properties of the additives used, for example solubility and volatility. Carbon and VOC emissions can be generated by melt compounding, while fogging seems to be less associated with degradation during melt conversion.

Automotive Industries (AI) asked Thomas Schmutz, Leader Technical Service & Application Development at SONGWON Industrial Group, how different stabilizer packages can potentially influence the emission level for interior PP-based TPO automotive applications.

Schmutz: Polyolefin properties are typically designed by creating a specific molecular architecture, which is molecular weight and molecular weight distribution. The main role of stabilizers is to preserve the molecular architecture during the different processing steps.

Ongoing efforts to improve product quality have led car manufacturers to use softer polymers – for dashboards, for example. These softer materials contain a variety of polymers with different molecular weight fractions, making them prone to volatile contaminant emissions, which can create deposits on the inside of the windscreen or cause odour. Emissions increase when polymers are exposed to high temperatures as a result of direct sunlight, for example.

In order to avoid potential health risks for end users, car manufacturers implement various quality control procedures for estimating the contaminant emissions of individual materials. The regulations of the Verband der Automobilindustrie (VDA –

German Association of the Automotive Industry) address the organic emissions from automotive components.

One test procedure, which is described in VDA 277, specifies gas chromatographic analysis with headspace sampling after thermal incubation of polymer samples in gas-tight flasks. Another procedure is described in VDA 278. Based on thermodesorption techniques, VDA 278 applies to non-metallic materials used for moulded components in automobiles. Two classes of compound are distinguished: low volatility (FOG) – oligomers with a carbon chain length of C14 to C32, and medium or high volatility substances (VOC) – those measuring up to C25.

Only efficient processing stabilization prevents emission:

- The classic base stabilization procedure for PP and TPO does not protect the polymer sufficiently during compounding. This leads to the formation of low molecular-weight fractions of PP or TPO, making them volatile and causing emissions. The emissions are typically measured in accordance with VDA 277 and VDA 278.
- Another cause of emission is the use of volatile or non-compatible light stabilizers. These are usually low-molecular-weight hindered amine light stabilizers (HALS) or UV absorbers (UVAs).
- In special cases, customers require exceptional long-term thermal stability (LTTS) of PP or TPO compounds. Classic systems based on phenolic antioxidants in combination with thioesters contribute to emissions because of the low-molecular- weight thioester.

It combines high long-term thermal stability with improved organoleptic properties.

AI: Are you able to tailor your products to customer specifications?

Schmutz: Yes. We can customize our products by adapting the loading level, for example. When developing formulations, we also balance cost against performance according to our customers' needs and applications.

AI: What are the key issues that your customers face during processing, conversion and end-use life cycles?

Schmutz: Increasingly stringent health and safety regulations are one challenge faced by automobile manufacturers and OEMs, and emissions are indeed an important issue here. Volatile substances can cause unwanted and potentially hazardous deposits on plastic parts or on the inside of the windscreen. They are key contributors to odour, sometimes perceived by end users simply as a "new car" feeling.

Manufacturers today have to balance a variety of complex factors. While there is strong demand for lighter weight plastic parts, these also have to be ever more resilient. High standards are required, yet costs must be kept as low as possible. This is not only a challenge as regards technology, but also on account of the growing popularity of individualized and increasingly sophisticated car interiors. Differentiation in colour and design is an important selling factor.

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AI: How can the new advanced stabilizer solutions help to reduce the emission level?

Schmutz: There are a number of ways:

- Classic base stabilization system: Our detailed studies show that by using a more powerful antioxidant package, such as SONGNOX® 621B, or one of our experimental stabilizers, such as XP 2048, the formation of low-molecular-weight PP or TPO can be reduced.
- Low-molecular-weight HALS or UVAs: The industry has moved from classic HALS and UVAs to more compatible light stabilizers such as SABO®STAB UV 91 50PP or SABO®STAB UV 228 50PP. Being more compatible with the polymer matrix, these stabilizers cause fewer emissions.
- Exceptionally high LTTS requirements: Our proposed solution involves taking the thioesters out of the formulation and replacing the classic high-molecular-weight phenolic antioxidant with a more powerful heat stabilizer. These additive solutions are still experimental and we are working to further improve performance.

AI: What is the emission level related to?

Schmutz: The emission level is related either to low-molecular-weight PP or TPO – in the range of C12 to C30 – or to additives with low molecular weights, i.e., about 250 g/mol.

AI: What is the range of the processing packages you offer?

Schmutz: We offer two additive packages for automobile interiors. SONGNOX® 621B is a commercial product that provides excellent melt flow and colour protection during processing of polyolefins, as well as long-term thermal stability. The other product, XP 2048, is experimental and currently being tested.

AI: What other innovative solutions can we expect from SONGWON Industrial Group in the future?

Schmutz: SONGWON Industrial Group intends to focus further on the stabilization of light-weight applications as this is an important automotive trend. PP filled systems based on carbon fibre, for example, are of interest as they are lighter in weight than glass fibre, and hence popular although still expensive. AI

Softer materials contain a variety of polymers with different molecular weight fractions, making them prone to volatile contaminant emissions.