

Strengthening Bond to Reinforce Automotive Window and Door Seals

The Challenge

Thermoplastic vulcanizates (TPVs) are widely used in automotive window and door weather seals. These materials combine the elastic properties of thermoset rubber with the processing ease of thermoplastics. Santoprene™ TPVs from ExxonMobil Chemical have a long and successful track record as the materials of choice for flexible, high-quality corner mold seals.

To address unmet customer needs for improved corner mold seals, ExxonMobil decided to develop a new generation of TPVs offering better bonding to ethylene propylene diene monomer (EPDM) rubber, commonly used as a substrate, as well as a low coefficient of friction (COF), which is important for easy opening and closing of doors and windows.

Key to this initiative was finding new additive technologies to help deliver the enhanced performance ExxonMobil needed. The company began collaborating with DuPont on the use of its advanced silicone-based additives, which promised to surpass the traditional organic additives ExxonMobil had been using in its Santoprene TPV grades.

The main objective of the collaboration was to improve bonding performance with EPDM while lowering COF at the same time. This was a major challenge because reducing COF to increase sliding performance can negatively impact bonding. In addition to achieving this balance, ExxonMobil needed to avoid compromising other important properties. Further, the company wanted the new TPVs to deliver better surface finish, UV stability and good flow properties.

The Solution

To meet ExxonMobil's needs, the DuPont development team chose to use a combination of engineered silicone-based technologies, such as DOW CORNING™ HMB 0221 MASTERBATCH. The key attributes of these technologies, some of which are patented, include: COF reduction, anti-scratch performance, high UV stability and enhanced processing.

DuPont did everything possible to help ExxonMobil meet its accelerated development timeline for the new TPVs. After reproducing the Santoprene TPV formulations using its silicone additives, DuPont produced sample compounds internally so ExxonMobil could quickly move to the testing phase. The two teams took a flexible approach, with an open exchange of data and best practices, to expedite the process of narrowing the field to the formulations that are used today. As a result, the



project took only three years – an unusually short development period.

This joint effort was a global undertaking, mirroring the worldwide reach of ExxonMobil. The initial collaboration work was done from the European headquarters of ExxonMobil. Pre-compounding work for testing was performed by DuPont in Europe. Subsequently, the project was split among several ExxonMobil locations across the globe.

The Success

The project experts found that synergies between a lower molecular weight silicone polymer and an ultra-high molecular weight silicone polymer delivered the low COF that ExxonMobil was looking for.

Importantly, a better COF would allow customers to eliminate a costly and time-consuming post-coating step previously needed to boost slip performance.

While improving sliding properties vs. the organic additives used in the existing Santoprene TPV grades, the silicone technology also enhanced bonding performance to dense EPDM rubber, a critical property for overmolding. Other key benefits of the new formulations include:

- Higher flow for improved processing ease and throughput
- Better abrasion resistance to protect against damage from slammed doors
- Improved stability under UV light exposure to prevent cracking and discoloration

ExxonMobil incorporated the final formulations into the new Santoprene TPV B260 range, available in Shore A hardnesses of 70 and 80. This new technology platform will allow ExxonMobil to expand its offering to different hardnesses for automotive corner seal molding.

ExxonMobil was able to quickly develop and launch these new, high-performance Santoprene TPV grades thanks to the exceptional commitment and technical expertise of DuPont. The team's extensive knowledge, skills and laser-focused customer support enabled ExxonMobil to deliver product by the target date, making this collaboration a resounding global success.

From DuPont's perspective, the collaboration with ExxonMobil achieved much more than breakthrough TPV products. It also laid the foundation for future projects that leverage the unique attributes of DuPont's silicone technologies to solve industry challenges and deliver a better consumer experience.



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