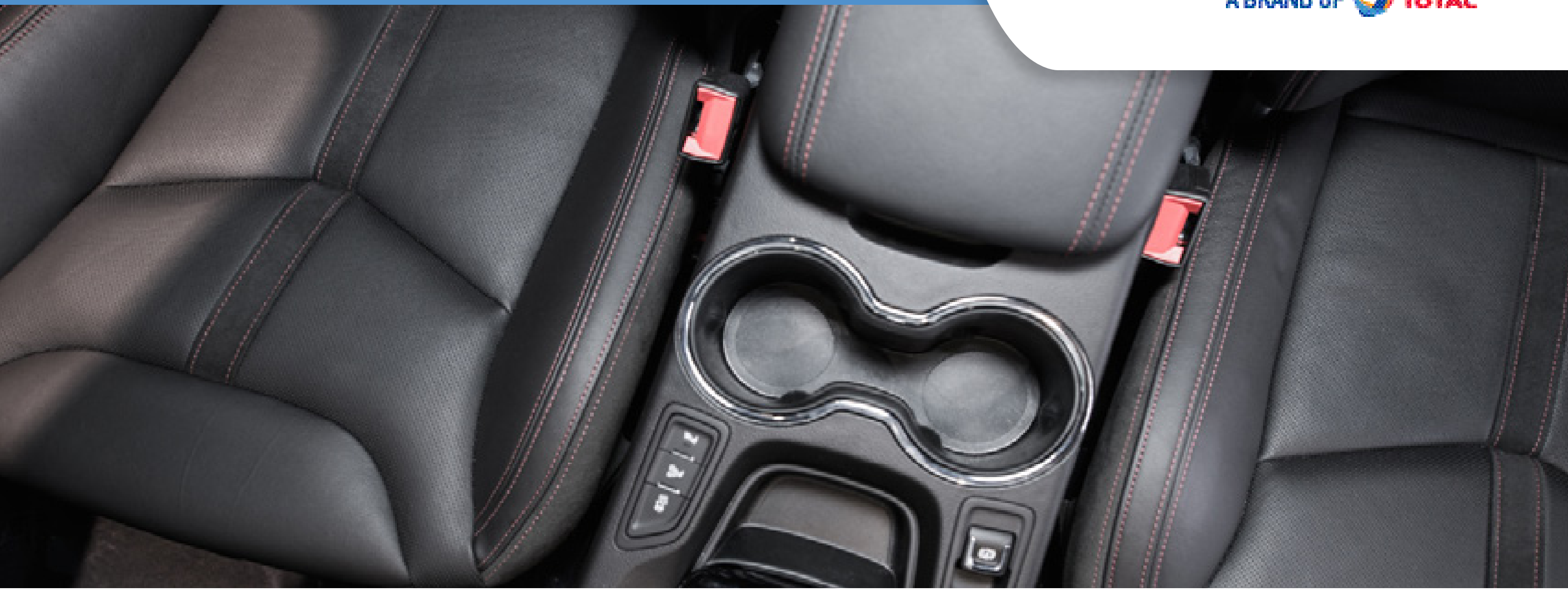
CRAY VALLEY
A BRAND OF TOTAL



BENEFITS

- Increased tear strength
- Increased tensile strength
- Less oil migration

TARGET MARKETS/ APPLICATIONS

- Automotive
- Home goods

ADDITIONAL INFO

- **SDS:** Wingtack® 10
- **Technical Update:** Wingtack® Aliphatic Resins Improve Performance of SEBS Thermoplastic Elastomers

Wingtack® 10 as a Processing Aid for Styrene Block Copolymer-Based Soft-Touch Thermoplastic Elastomers

Description

Styrene block copolymers (SBC) have been effectively used in thermoplastic elastomers (TPEs) for many years. However, it is possible to enhance properties like tensile strength and tear strength, and reduce oil migration by substituting Wingtack® 10 for process oil. This technical update will examine the effect of Wingtack 10 aliphatic C5 type liquid resin on the properties of a widely used SBC.

SBCs have a distinct two-phase (domain) structure and each phase contributes unique properties. The styrenic domains provide a rigid cross-link type function while the butadiene midblock, which has a low glass transition temperature (Tg), will impart flexibility and toughness. The two phases also provide the opportunity to modify or enhance the performance of the entire polymer by judicious selection of an additive to modify the targeted phase. For example, the hard polystyrene endblock phase can be modified by choosing additives that are compatible with the aromatic domains. In contrast, the softer, rubbery midblock phase can be modified by choosing additives that are primarily aliphatic in their chemical composition or nature.

TOTAL
COMMITTED TO BETTER ENERGY

The TPE compounds used in this study are shown in Table 1. Wingtack 10 resin was compounded into TPE by replacing process oil at 5%, 15%, 20% and 30% of the total formulation. The process oil and Wingtack were dispersed onto the SEBS prior to compounding. The SEBS used was a commercially available product with a 30% polystyrene content and a melt flow rate (MFR) of 5 g/10 min. Compounding was completed on a 20mm co-rotating twin screw extruder with an L/D ratio of 40:1. An increasing temperature profile from 165 °C to 180 °C was used. All samples were pressed into sheets with nominal dimensions of 4” x 4” x 0.07” thick at 180 °C using a Carver press at 15,000 psi for 4 minutes. Samples were die cut, and conditioned in a 23 °C and 50% relative humidity environment for 40 hours before testing using ASTM D412 and ASTM D624.

Table 1: TPE Compounds

	PPC 4720WZ (%)	SEBS (%)	Drakeoil® 35 (%)	$CaCO_3$ (%)	Wingtack® 10 (%)	Antioxidant (%)
TPE Control	24.9	30	30	15	0	0.1
Sample 1	24.9	30	25	15	5	0.1
Sample 2	24.9	30	15	15	15	0.1
Sample 3	24.9	30	10	15	20	0.1
Sample 4	24.9	30	0	15	30	0.1

Figure 1 shows tensile and tear strength, as well as modulus at 50% elongation values for all of the formulations. Improving tear strength is one of the primary benefits when substituting process oil with Wingtack 10. Tear strength improvement can be as high as 90% when completely replacing process oil with Wingtack 10. Substituting half of the process oil with Wingtack 10 improves tear strength by nearly 35%. Tensile strength is also improved with the use of Wingtack 10. Tensile strength can be improved by up to 48%.

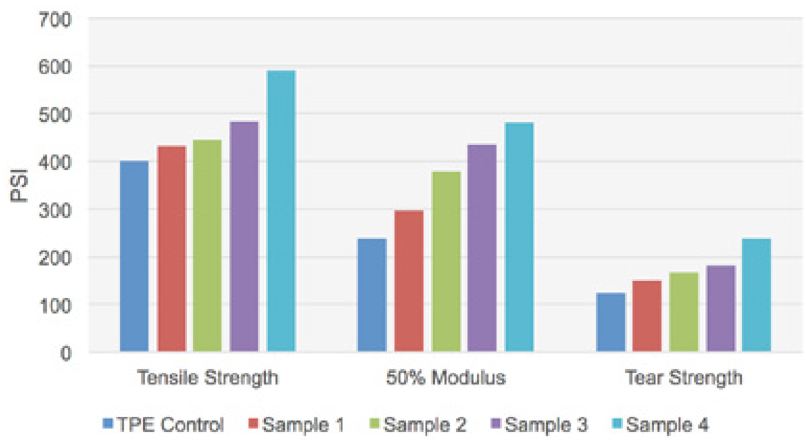


Figure 1: Tensile strength and 50% modulus using ASTM D412 and tear strength using ASTM D624 Die C.

Processability is improved with the inclusion of Wingtack 10. Wingtack increased melt flow rate (MFR) from 40.8 g/10 to 48.6 minutes. Figure 2 shows melt flow rate of the TPE controls and samples.

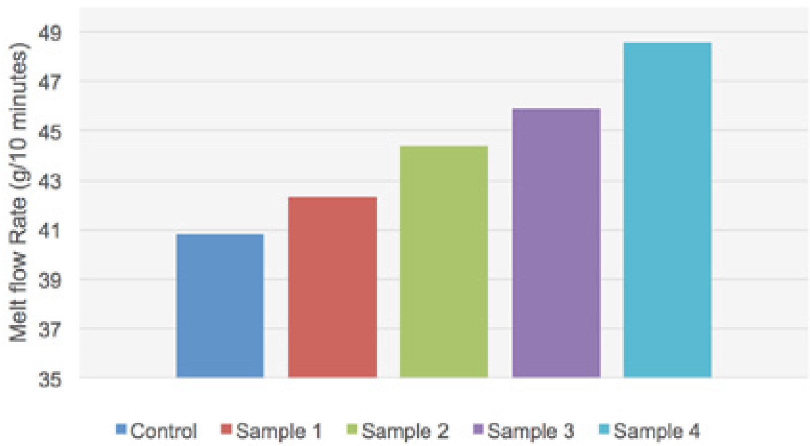


Figure 2: Melt flow rate ASTM D1238 at 210 °C using 2.16 Kg.

Oil migration can be reduced by substituting process oil for Wingtack 10. An accelerated aging at 100 °C for 100 hours showed that Wingtack 10 migrated less than process oil. Weight loss of Sample 4 was only 2% instead of 5% from process oil. Figure 3 shows percent weight loss of samples aged.

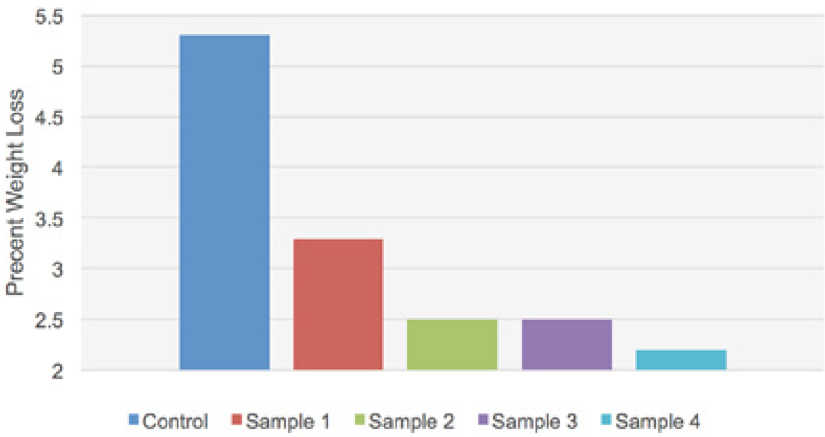


Figure 3: Percent weight loss from samples aged 100 hours at 100 °C.

Wingtack 10 also mitigated shore A hardness increase due to oil migration only increasing shore A by 2.5 versus a shore A increase of 6.5 with process oil. Figure 4 shows shore A hardness after both pre-aging and post-aging.

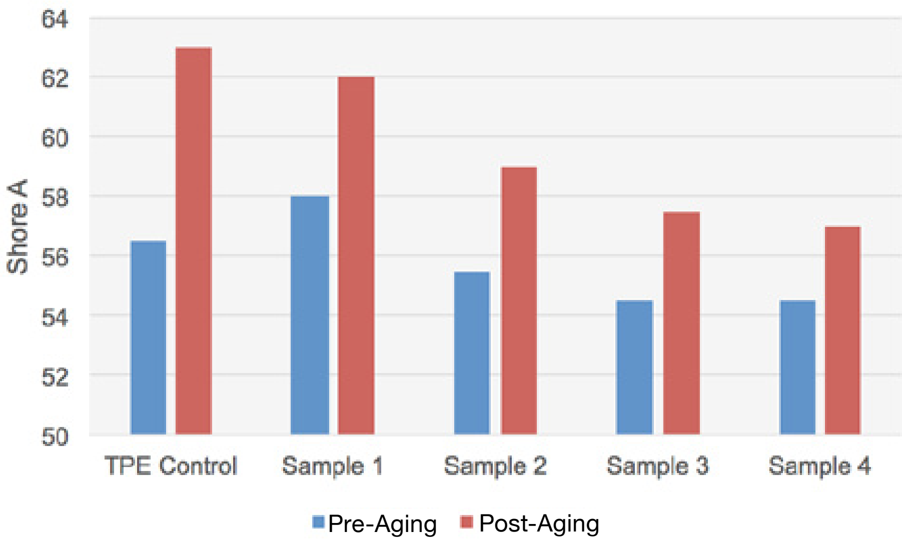


Figure 4: Shore A hardness pre-aging and post-aging.
Samples were aged for 100 hours at 110 °C.

Summary

Replacing process oil with Wingtack 10 resin in a styrenic TPE will improve tensile strength and tear strength while mitigating oil migration. With a partial substitution of Wingtack 10 in place of process oil, improvements in tear strength can be obtained while maintaining hardness.

Table 2: Actual values of ASTM D412, D624 Die C, and D1238 as well as aging weight loss and shore A hardness values.

	Wingtack® 10 Content (%)	Tensile Strength (PSI)	50% Modulus (PSI)	Tear Strength (PSI)	MFI (210 °C 2.16 Kg) (g/10 min)	Aging Weight Loss (%)	Shore A Hardness (Pre-Aging)	Shore A Hardness (Post-Aging)
TPE Control	0	399	239	124	40.8	5.3	56.5	63.0
Sample 1	5	432	298	149	42.3	3.3	58.0	62.0
Sample 2	15	443	376	168	44.4	2.5	55.5	59.0
Sample 3	20	484	434	181	45.9	2.5	54.5	57.5
Sample 4	30	590	480	239	48.6	2.2	54.5	57.0

Appendix

- PPC 4720WZ a TOTAL Polypropylene impact copolymer with an MFR of 25 g/10 minutes
- SEBS used was Kraton™ G 1651
- Antioxidant used was Irganox® 1010

About Total Cray Valley

TOTAL Cray Valley is the premier global supplier of specialty chemical additives, hydrocarbon specialty chemical, and liquid and powder tackifying resins used as ingredients in adhesives, rubbers, polymers, coatings and other materials. TOTAL Cray Valley has pioneered the development of these advanced technologies, introducing hundreds of products that enhance the performance of products in energy, printing, packaging, construction, tire manufacture, electronics, and other demanding applications.

For more information, please visit **www.crayvalley.com**

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