

# Winning the Race in Footwear Foams

## INFUSE™ OBCs Offer Exceptional Performance and Lower Overall Costs than E-TPUs

Since their introduction to the footwear market in 2014, INFUSE™ Olefin Block Copolymers (OBCs) have enabled the development of athletic shoe midsoles with significantly improved performance.

This advanced technology from The Dow Chemical Company (Dow) offers opportunities for excellent long-term cushioning performance with outstanding rebound, comfort, and durability when used alone or in blends with ethylene vinyl acetate (EVA) – the historical, low-cost industry standard.

Another recent innovation, expanded thermoplastic polyurethane (E-TPU), has received widespread attention for its energy management capabilities. This closed-cell, elastic particle foam provides softness and flexibility using bead foam technology to offer improved rebound and many other similarities to OBC-based foams.

### Let's Start with the Bottom Line

While both INFUSE™ OBCs and E-TPUs are based on block technologies that alternate soft and hard segments, polyurethane chemistry is inherently more expensive than the all-olefin INFUSE™ OBC chemistry. E-TPUs also require special processing to achieve their version of advanced energy recovery performance. The higher total system cost of E-TPUs makes INFUSE™ OBCs a much more cost-efficient option. Equally important, the lower cost OBC technology not only offers comparable performance to E-TPUs, but can also outperform them in some key areas.

### Rebound

Rebound performance is an important aspect of footwear energy management. In addition to helping cushion the foot from impact, high levels of rebound also help propel the athlete onward. Figure 1 reveals that foam made with INFUSE™ 9107 OBC offers improved performance compared to the other materials tested.

### Softness

Another critical element of midsole performance is softness – especially over the wide range of temperatures athletes can encounter. Figure 2 shows that foam made with E-TPU exhibits higher modulus at very low temperatures than INFUSE™ OBC-based foams. This correlates with increased stiffness/reduced softness. As the temperature increases, the softness of the E-TPU foam becomes comparable with that of the foam made with INFUSE™ 9107 OBC. Compared to EVA, however, both INFUSE™ OBCs and E-TPU offer lower modulus for improved softness across a broad temperature range.

The inherent softness of INFUSE™ OBCs is related to their low crystallinity soft segment and final polymer density. As a result, the softness/stiffness levels of OBC-based foam formulations can be easily optimized by selecting a higher or lower density product grade or blending. Modifications can even be made during the manufacturing process to ensure the desired results are achieved.

### Compression Set and Recovery

Low compression set and strong recovery also play important roles in developing durable, long-lasting midsoles. Figures 3 and 4 (next page) compare compression set at room and elevated temperatures after 30 minutes and 24 hours of recovery. At room temperature (Figure 3), the E-TPU foam displays significantly higher compression set than the OBC-based foams. However, when aged at 50°C for 6 hours and allowed to recover for 24 hours (Figure 4), E-TPU shows comparable performance to the “workhorse” INFUSE™ 9107 OBC.

Figure 1: Rebound Performance<sup>(1)</sup>

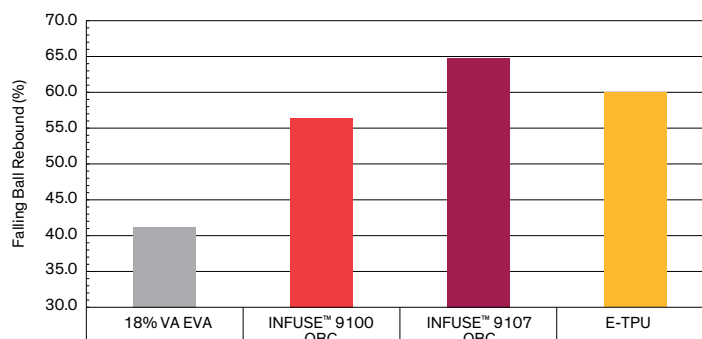
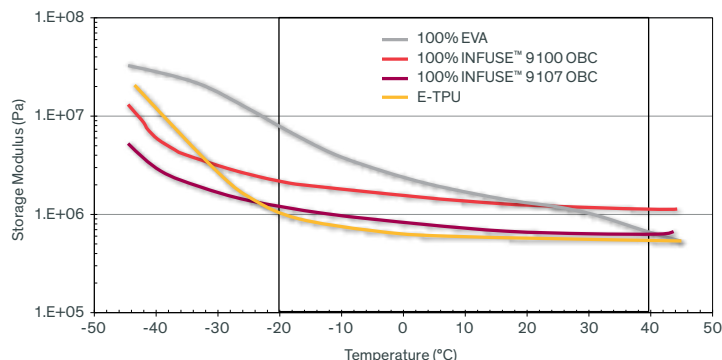


Figure 2: Dynamic Mechanical Analysis of Storage Modulus (Stiffness)<sup>(1)</sup>



<sup>(1)</sup>Data per tests conducted by Dow. Additional information available upon request. Properties shown are typical, not to be construed as specifications. Users should confirm results by their own tests.

Both INFUSE™ OBCs and E-TPU enable significant improvements in compression set resistance and recovery compared to EVA at elevated temperatures.

In dynamic fatigue testing (Figure 5), the E-TPU foam offers comparable performance to the INFUSE™ OBC-based foams, while both alternatives recover much faster and to higher levels than EVA. The ability to recover over time following static and dynamic compression points toward extended durability and service life.

### Leading the Way from Start to Finish

Besides their potential as low-cost, high-performance alternatives to E-TPU in midsole applications, INFUSE™ OBCs enable several other advantages.

First and foremost, converting from EVA to E-TPU requires significant startup costs, with high levels of investment in new manufacturing capacity. E-TPU is also sensitive to moisture while being pelletized and should be properly dried, adding potentially unnecessary time to the manufacturing process. In contrast, INFUSE™ OBCs are a “drop in” solution that can typically be used with existing equipment.

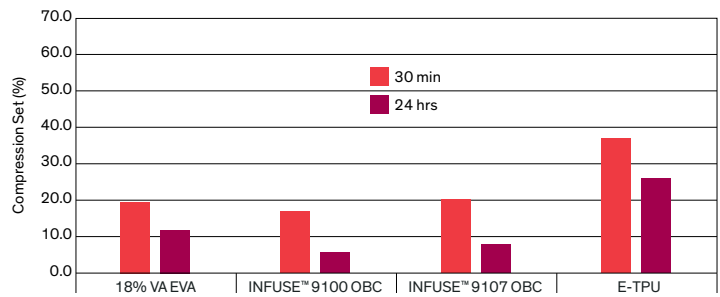
In addition, midsoles made with up to 100 percent INFUSE™ OBC content bond well with other footwear components using conventional adhesives. Ask your Dow representative about improved bonding capabilities for high INFUSE™ OBC content applications.

Finally, some types of E-TPU may suffer from poor weatherability and discoloration following environmental exposure. Table 1 provides an overview of several variables involved in producing footwear midsoles with E-TPUs and INFUSE™ OBCs.

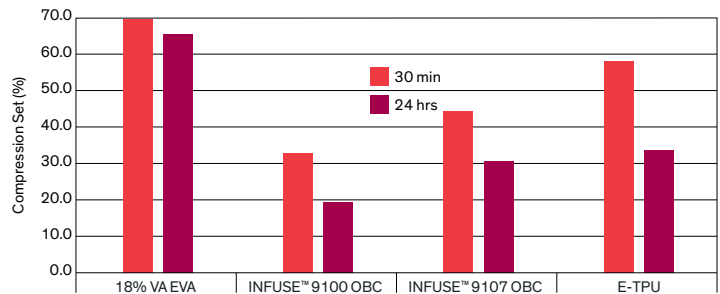
**Table 1:** E-TPUs vs. INFUSE™ OBCs – Comparison of Key Variables<sup>(1)</sup>

Variable	E-TPUs	INFUSE™ OBCs
Chemistry	Polyurethane	Polyolefin
Material Cost	High	Low
Handling/Drying Costs	High	Low
Density	Medium	Low
Low Density Foam Capability	Medium	High
Processing Sensitivity	High	Low
Capital Requirements	High	Low
Optimize/Change Performance	Low	High

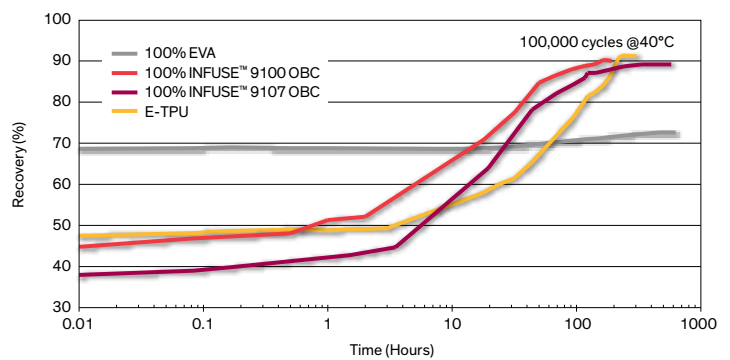
**Figure 3:** Static Compression Set at 23°C/22 hrs<sup>(1)</sup>



**Figure 4:** Static Compression Set at 50°C/6 hrs<sup>(1)</sup>



**Figure 5:** Recovery After Dynamic Fatigue<sup>(1)</sup>



<sup>(1)</sup>Data per tests conducted by Dow. Additional information available upon request. Properties shown are typical, not to be construed as specifications. Users should confirm results by their own tests.

For more information on how INFUSE™ OBCs can help improve your performance footwear or other foam applications, contact your Dow Elastomers representative, visit [www.dow.com/footwear](http://www.dow.com/footwear), or call the nearest location listed below.

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