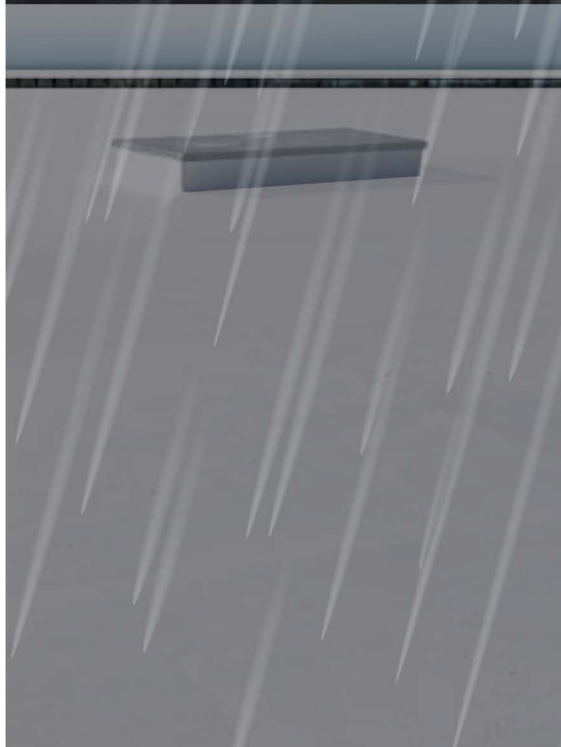
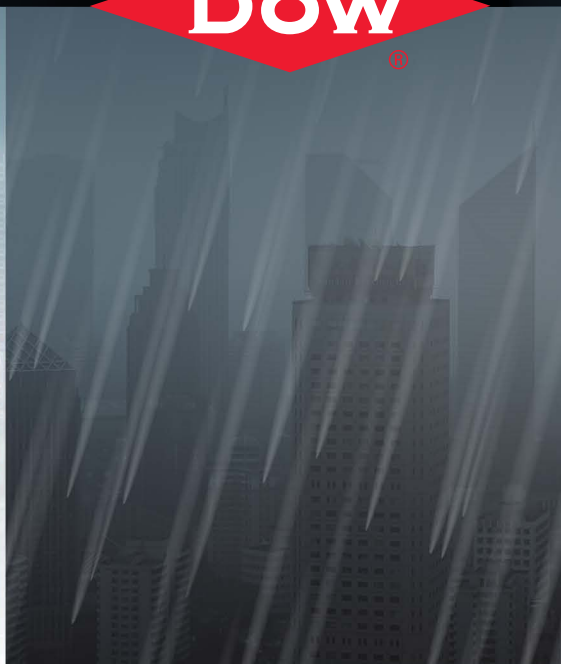


Flexible, long-lasting **for all extremes**

Roofing membrane science from Dow

Dow



How can we help answer **your roofing challenges?**

Resistance to weather, temperature, chemicals, and fire. These are the toughest challenges faced by flat and low-sloped roofing. Teaming up with Dow lets you take them on with one of the most diverse portfolios of roofing membrane science available. It gives you a development partner that's always searching for better, more efficient, and sustainable answers. Backed by in-depth formulation and application experience, global reach, and local service.

By combining our efforts, we can meet the extreme demands placed on your roofing and waterproofing systems while also maintaining or improving the flexibility and durability needed for long service life.

roofing solutions by



Engage
polyolefin elastomers

Versify
plastomers and elastomers

Elvaloy
copolymers for alloys

Nordel
EPDM



A diverse range of options

Our portfolio of materials for roofing membranes features advanced polymers for thermoplastic polyolefin (TPO), polyvinyl chloride (PVC), and ethylene propylene diene terpolymer (EPDM) systems. These proven, highly respected solutions can help you develop custom-tailored formulations that fit specific designs, production processes, and end-use requirements.

TPO system solutions

With several advantages over incumbent materials, ENGAGE™ TR Polyolefin Elastomers (POEs) represent our current state-of-the-art for TPO-based membrane formulations.

Increased longevity, flexibility, and filler loading

VERIFY™ Plastomers and Elastomers offer a propylene-based solution that can be formulated to match the properties of incumbent TPO roofing membranes. ENGAGE™ TR POEs, however, offer an ethylene-based solution that has inherently better longevity, and can be formulated to produce membranes with significantly improved flexibility (Figure 1). The unique design of ENGAGE™ TR also allows increased filler loading, which can, in turn, be used to improve fire performance.

Enhanced property performance

In a comparison of formulations based on a typical polypropylene (PP) TPO and ENGAGE™ TR (Table 1), the Dow material offers:

- 40 percent lower modulus for increased flexibility and ease of installation
- Reduced glass transition temperature (T_g) for better low temperature toughness
- Comparable tensile strength

Table 1: Comparison of key properties⁽¹⁾

Roofing membrane formulation	Tensile modulus (MPa)	T_g (°C)	Tensile strength (MPa)
ENGAGE™ TR POE-based ⁽²⁾	49	-50	17.5
PP TPO-based ⁽³⁾	82	-20	17

And, while the initial tensile strength is essentially the same, excellent thermal stability can help membrane made with ENGAGE™ TR POE deliver better property retention over time (Figure 2).

Excellent weatherability/UV resistance

In Figure 3, scanning electron microscope (SEM) photography taken after 10,000 hours of accelerated weathering reveals surface cracking in the PP TPO-based membrane. In sharp contrast, the ENGAGE™ TR POE-based membrane remains crack free. This indicates higher levels of UV and weather resistance, which correlate to longer service life.

Figure 1: Comparison of ethylene- and propylene-based formulations⁽¹⁾

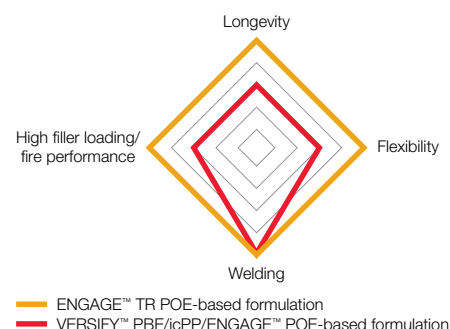


Figure 2: Tensile strength retention after oven aging at 116°C (ASTM D6878)⁽¹⁾

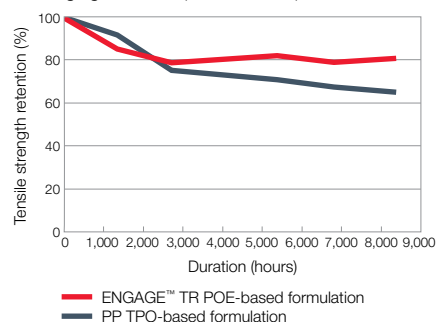
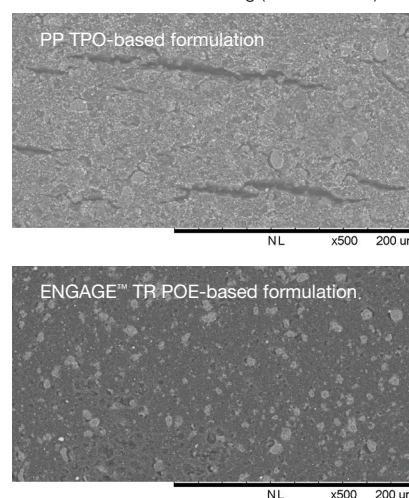


Figure 3: Membrane comparison after 10,000 hours of xenon arc weathering (ASTM D6878)⁽¹⁾



⁽¹⁾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.

⁽²⁾Formulation: ENGAGE™ TR 8010 60.6%, Stabilizer MB: 3.0%, Mg(OH)₂: 36.4%

⁽³⁾Formulation: HIFAX CA10A 66.7%, Stabilizer MB: 3.3%, Mg(OH)₂: 30%

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PVC system solutions

To maintain the long-term flexibility and durability needed for roofing membrane, PVC-based systems require the use of a plasticizer. Unfortunately, traditional liquid plasticizers (LPs) tend to migrate out of the membrane, leading to drying and cracking over time.

ELVALOY™ Ketone Ethylene Ester (KEE) Terpolymers, on the other hand, offer excellent performance as non-migrating plasticizers. By enhancing resistance to chemicals, microbials, and impact – as well as low temperature performance and service life – they help raise the bar for durability in PVC roofing.

Chemical resistance

Figure 3 shows the favorable performance of membrane featuring ELVALOY™ KEE compared to six different PVC/LP combinations after exposure to two tough reagents: Jet A fuel and compressor oil.

Low temperature flexibility

Figure 4 compares the ability to bend test membranes at low temperatures before and after extraction of the plasticizer by hexane. Membranes made with ELVALOY™ KEE and ELVALOY™ KEE HP (high performance) offer 20 and 25 degrees better original performance, respectively, than the PVC/LP membrane tested. This advantage increases to 55 and 60 degrees after extraction.

Long-term durability

The non-migratory performance of ELVALOY™ KEE plasticizers is demonstrated clearly in Figure 5, where the PVC/LP-based membrane tested shows severe cracking and the PVC/ELVALOY™ KEE-based sample shows none.

Figure 3: Chemical resistance: Jet A fuel and compressor oil⁽¹⁾

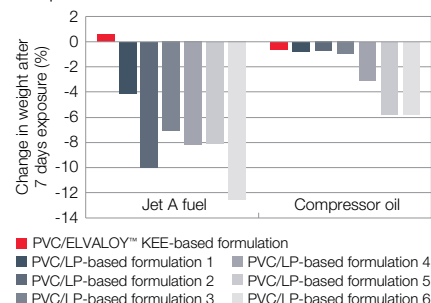


Figure 4: Low temperature bend: Before and after hexane extraction⁽¹⁾

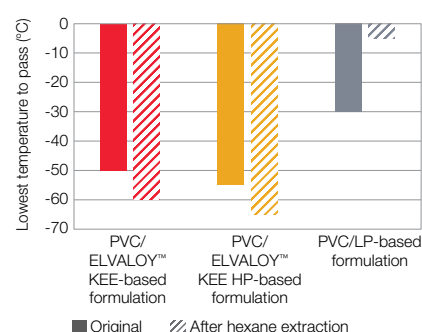
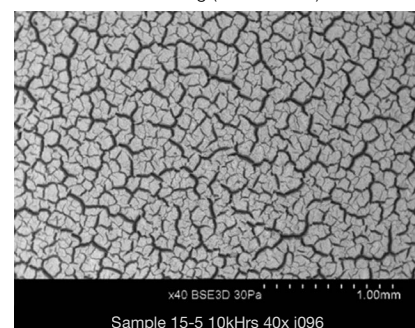
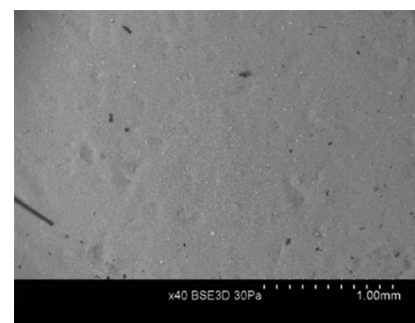


Figure 5: Membrane comparison after 10,000 hours of xenon arc weathering (ASTM G155)⁽¹⁾



PVC/LP-based formulation



PVC/ELVALOY™ KEE-based formulation

⁽¹⁾ 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.

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How can we enhance **roofing performance?**

Whether you're working with TPO-, PVC- or EPDM-based systems, our roofing membrane science can offer:

- Flexibility that lasts, even in thicker sheet installations
- Long-term durability for life expectancy of 20+ years
- Weatherability/UV resistance that meets or exceeds appropriate industrial standards
- Fire performance with halogen-free, low-smoke, low-ignitability, and low-fuel load options
 - Light color/cool roof formulations to reduce heat absorption
- Multiple attachment options, including fully adhered, heat welded, mechanical, and/or ballasted systems



How can we make **better formulations faster?**

Working with us lets you tap into advanced formulation capabilities and process know-how. R&D centers in Horgen, Switzerland; Lake Jackson, Texas (USA); Shanghai, China; and Sao Paulo, Brazil offer technical expertise and testing facilities around the world. And our lab-scale, direct-extrusion flexible membrane line provides opportunities for:

- Complete simulation of the industrial production process
- Fast formulation development with subsequent scale-up



EPDM system solutions

Longevity, weather resistance, flexibility, and low temperature toughness are the key strengths of EPDM roofing. As a longtime leader in EPDM technology, NORDEL™ resins set the pace. Now, a new generation of NORDEL™ EPDM is taking it up a notch with opportunities for improved mechanical performance, increased filler loading, and better processability.

Improved performance, even at higher loads

The baseline data in Figure 6 shows that a formulation based on XUS 51110.00 EPDM offers 50 percent higher tensile strength (green strength) than a leading incumbent formulation. Not only that, but it also maintains increased performance levels as more filler is added. The reason behind this exceptional performance is the next-generation product's high molecular weight fraction.

Enhanced processability

High filler loading can cause inefficient mixing and poor dispersion of additives. In addition to potentially impacting the end-use product, this typically leaves a “trail” of unmixed additive deposits on rollers and other processing equipment (Figure 7A). Next-generation NORDEL™ EPDM (Figure 7B) enables more efficient mixing and dispersion, resulting in better cohesive strength, fewer deposits, and less need for cleaning.

Let's keep rolling

Our ongoing investment in innovation is helping develop the next generation of roofing membrane science. By collaborating with customers like you and other industry experts, we're constantly striving to deliver improved processability, installation, and end-use performance while meeting and exceeding evolving regulatory requirements. We'd love to hear your ideas.

How can we help you?

Working side-by-side, we can find answers to your roofing and waterproofing system challenges. Let's look beneath the surface to develop better, longer-lasting, more sustainable roofing membrane. Please contact your Dow representative, call the nearest location on the following page, or visit www.dow.com for more information.

Figure 6: Green tensile strength at selected levels of filler loading⁽¹⁾

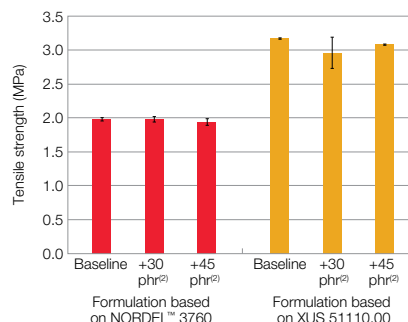


Figure 7: Mixing efficiency/cohesive strength/processability⁽¹⁾



A: Formulation based on NORDEL™ 3760 leaves significant amount of deposits on roller.

B: Formulation based on XUS 51110.00 leaves virtually no deposits.

⁽¹⁾ 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.

⁽²⁾ Additional phr is distributed among carbon black, oil, and filler.

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About Dow

The Dow Chemical Company (Dow) combines science and technology knowledge to develop premier materials science solutions that are essential to human progress. Dow has one of the strongest and broadest toolkits in the industry, with robust technology, asset integration, scale, and competitive capabilities that enable it to address complex global issues. Dow's market-driven, industry-leading portfolio of advanced materials, industrial intermediates, and plastics businesses deliver a broad range of differentiated technology-based products and solutions for customers in high-growth markets such as packaging, infrastructure, and consumer care. More information can be found at www.dow.com.

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