

CERANOVUS™ PRODUCTS

for Roofing Applications

GreenMantra™ Ceranovus™ A Series Synthetic Wax Products,
Made With 100% Recycled Content, Improves Roofing Asphalt Performance

Today's roofing manufacturers are searching for raw materials to make higher performing, longer-lasting asphalt roofing products with the best cost/performance ratio possible. Using bitumen asphalts modified with styrene-butadiene-styrene (SBS) or atactic polypropylene polymers (APP) for rolled asphalt roof sheets and shingles is one strategy for producing roofing materials resistant to climatic extremes and mechanical stress. But GreenMantra Technologies, a leading-edge North American specialty chemical manufacturer, is offering a new product that can further enhance roofing asphalt performance while lowering costs via faster processing.

Through a proprietary process, GreenMantra is producing a series of asphalt additives made with 100% recycled materials and designed for all asphalt roofing and underlayment applications. When combined with either modified or unmodified asphalt, these Ceranovus™ A Product Series polyethylene and polypropylene wax-based products improve the asphalt's application and performance characteristics in roofing applications. In asphalt flux, GreenMantra's additives can improve heat stability, increase softening point, and lower viscosity for faster processing. In SBS or APP modified bitumen (MB), they can also hasten polymer dispersion and reduce mixing times.

Sourcing from recycled polyolefin plastics means GreenMantra's waxes offer competitive pricing and also address many of the challenges associated with petroleum-based wax products, such as constrained supply and cost volatility. It also supports Leadership in Environmental Energy and Design (LEED) building material qualification.

Summary of Benefits

Results of application testing are detailed below, but here is a brief overview of the benefits gained from adding GreenMantra's wax products to roofing asphalt formulations.

- **Faster production for lowered costs**
 - Decreases asphalt viscosity at process temperatures for faster line speeds
 - Reduces the mixing time necessary to achieve optimum polymer dispersion (phase inversion) in SBS or APP modified bitumen by up to 30%
 - Customizable properties depending upon process requirements
- **Improved product performance**
 - Better heat stability with significantly improved energy of deformation (force ductility), meaning less warpage during storage, transport and use
 - Increased softening point and decreased penetration at various temperatures, without impact on cold temperature performance
 - No color migration or staining
 - Complements effects of SBS or APP modification, or oxidation
- **LEED credit**
 - Certified Recycled Content product
 - Roofing/siding or insulation containing Ceranovus A Product Series waxes support various environmental credits
 - Cost-competitive, unlike many materials with recycled content

Properties of Ceranovus A Product Series Waxes for Roofing Applications

Ceranovus A Product Series waxes are delivered as dark, 2-3 millimeter pastilles. The standard products listed cover a range of densities, melting points, and viscosities (melt flow at various temperatures) as shown in Table 1. Depending upon manufacturing requirements, custom waxes can also be supplied if necessary.

Table 1: Properties of Ceranovus A Product Series waxes for roofing asphalt

Ceranovus Waxes	DENSITY (g/cm ³) ASTM D1298	DROP POINT (°C) ASTM D3954	NEEDLE PENETRATION @ 25°C (dmm) ASTM D1321	VISCOSITY CPS @ 140°C BROOKFIELD
A115L	0.90 - 0.95	112-118	1-4	100-350
A120	0.92 - 0.95	117-123	1-2	350-1050
A125	0.92 - 0.95	122-128	1-2	1050-3000

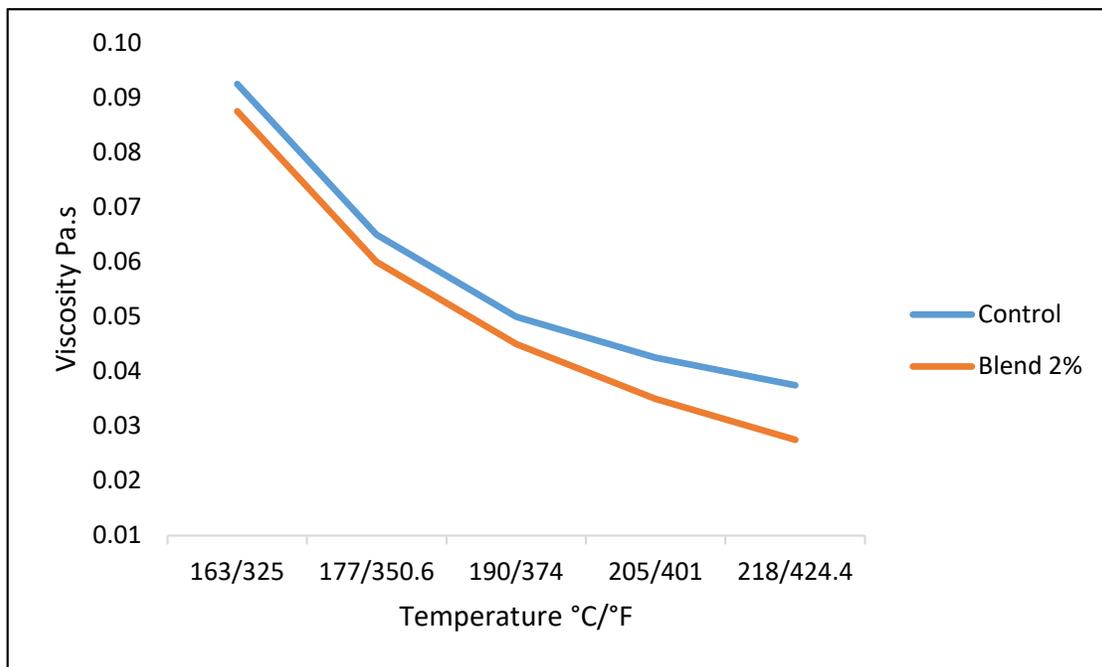
Application Testing

To examine the effect of modifying asphalt by incorporating a GreenMantra Ceranovus wax additive, we engaged [PRI Asphalt Technologies, Inc.](#) for third party testing and evaluation. The first formulation tested consisted of 150/200 penetration grade asphalt with 10 % KRATON® SBS linear block copolymer, 20% limestone filler, and 0.5-4% Ceranovus A Product Series wax. The test asphalt's performance was compared with that of a control formulation without any wax.

- **Viscosity reduced**

The viscosities of both samples were compared over a range of temperatures between 163-218°C (Figure 1). Including Ceranovus wax in the formulation decreased the asphalt's viscosity at all temperatures tested. This drop in viscosity can correlate to faster line speeds in roll or shingle production.

Graph 1: Viscosity in relation to temperature of control asphalt and asphalt modified with 2% Ceranovus A115L wax; the wax blend's viscosity is lower throughout the temperature range



- **Mixing times decreased by 30%**

Test asphalt samples were prepared as above using SBS modified bitumen with 2% of either GreenMantra Ceranovus A115L or A125 wax. Fluorescence microscopy results for these samples were compared with results for control polymer-modified asphalt, without wax additives. Results are shown in Table 2.

Table 2: Summary of mix times to achieve full dispersion in three modified asphalt formulations, two containing Ceranovus wax, and one control; note faster dispersion with wax

Time	Control	10% SBS + A115	10% SBS + A125
2 Hours			
3 Hours			
5 Hours			
7 Hours			
8 Hours		N/A	N/A
10.5 Hours		N/A	N/A

This test demonstrates the efficacy of the wax modifiers in reducing the mixing time necessary to achieve optimum polymer dispersion and phase inversion. Over 30% improvement in mixing time is seen compared to the control modified asphalt—an important processing economy.

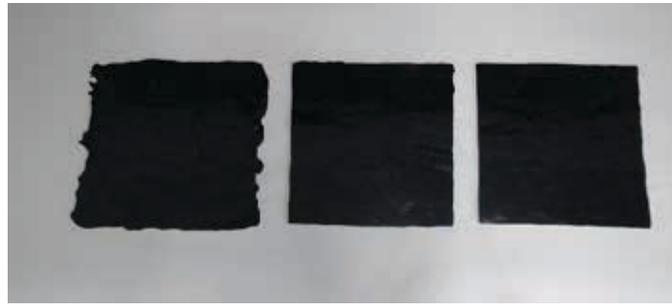
- **Improved structural and thermal stability for modified bitumen**

Dimensional integrity under mechanical strain and in extreme temperature conditions is a crucial aspect of roofing material performance. The impact of adding 2% Ceranovus wax modifiers to the structural integrity of asphalt modified with SBS is shown in Table 3 and Figure 2. Dimensional heat stability improves significantly, as does force ductility.

Table 3: Impact of two Ceranovus modifiers on SBS-modified asphalt properties; note improvement in dimensional heat stability and force ductility while **low temperature behavior remains unchanged**

Ceranovus Waxes	CTMB	HEAT STABILITY		FORCE DUCTILITY	
	Fail Temperature (°C) ASTM D5147M	Dimensional Stability (% change) ASTM D5147/D1204		@25°C AASHTO T300M	
		Transverse	Parallel	Force Ratio (f1/f2)	Deformation Energy (J/cm ²)
Control	-23.9	+10	+6.4	0.37	3.2
A125	-23.9	+2	+1.2	0.52	6
A115L	-23.9	+1.2	+1.6	0.54	5.4

Figure 1: Dimensional heat stability at 80°C (ASTM D1204) of rolled asphalt sheets made with and without wax additives



- **Higher softening point, lower penetration**

Raising the softening point of the asphalt component and making it stiffer by modification with polyolefin wax can raise the performance and durability of roofing materials. This is true for both SBS-modified asphalt (Table 4) and oxidized asphalt (Table 5). In the case of air-blown or oxidized asphalt, modification with Ceranovus wax can reduce processing times and energy costs, and lower emissions, by decreasing the degree of oxidation required to achieve desired performance parameters.

Table 4: Impact of wax modifiers on penetration and softening point in SBS-modified asphalt

Ceranovus Waxes	SOFTENING POINT (°C) ASTM D36	PENETRATION (dmm) ASTM D5		
		@4°C	@25°C	@46°C
Control	93.6	41	50	90
A125	106	35	39	55
A115L	102	34	40	60

Table 5: Impact of wax modifiers on penetration and softening point in oxidized type VI mopping asphalt

Ceranovus Waxes	SOFTENING POINT, 3% (°C) ASTM D36	PENETRATION @25°C, 3% (dmm) ASTM D5
	Control	102
A115L	114	12
A120	117	11

- **No color migration**

To ensure that adding wax to asphalt shingle does not lead to discoloration, asphalt samples containing wax were stain-indexed. In one sample, the wax was added before the SBS. In the other sample, the wax was added after the SBS. There was no bleeding or color staining by the wax product in either test sample.

Figure 2: Stain index of two SBS-modified asphalt blends including Ceranovus A115L wax (1-wax added before SBS, 2-wax added after SBS); no staining has occurred



Certified Recycled Content & LEED qualification

GreenMantra's Ceranovus A Product Series waxes are certified made with recycled content, providing roofing manufacturers products focused on the circular economy with transparent documentation and added support in qualifying for environmental product standard requirements and green building industry requirements such as U.S. Green Building Council's LEED certification.

Summary

Manufacturers of rolled asphalt roof sheets and shingles are looking to make their products stand out in the market place. Asphalt modified with GreenMantra's Ceranovus A Product Series waxes can contribute to better performance and warranties, environmental suitability, and competitive pricing—all of which can signal innovation and differentiate your roofing product.

Ceranovus A Product Series waxes offer time-, emissions- and cost-saving process benefits, such as decreased asphalt viscosity, faster dispersion of modifiers, and lowered requirements for other modifiers, such as SBS or APP, or oxidation. Performance benefits include increased durability through better thermal stability with higher softening points and less deformation. At the same time, despite improving warm weather performance, customizable Ceranovus brand waxes do not adversely affect cold weather performance, nor do they bleed or stain.

Ceranovus waxes are not only uniquely effective in improving the properties of asphalt for roofing applications, but GreenMantra is the only company making such a product from 100% certified recycled content. Use of this product will support LEED credits as well as help lower the cost of the roofing materials.

