

NorthStar Elastomers

Norst® Polymers & Tirecycle™ Rubbers

PRODUCTS AND SERVICES

Green/Sustainable - Solvent free using "Mechanochemistry", no processing waste or residue, can use off-spec material, products tailored to manufacturer end use. Products have been in use across the world for more than 25 years.

Norst® Custom Polymers

NorthStar Elastomers, LLC manufactures custom blended base rubber compounds and additives, used in the manufacture of adhesives and sealants for a wide range of usage and benefits. Generally Butyl or PIB based, compatible with NR, SBR, EPDM, PPE, most rubbers and plastics. Avoid aromatics, silicones, water-based mixtures. See *Properties Chart* for more Polymer product information.

Commercial Uses

- ◆ Hot melt adhesives
- ◆ Pressure sensitive tapes
- ◆ Sealants - back bedding insulated glass
- ◆ Cable fill
- ◆ Moisture barrier coatings
- ◆ Pipeline protection
- ◆ Resin extenders and modifiers
- ◆ PPE modifiers - injection molding
- ◆ Non-tacky elastomeric membrane formers
- ◆ High temperature resistant pressure sensitive adhesives
- ◆ Modified asphalt - roofing, paving, waterproofing

Major Features & Benefits

- ◆ Longer open time for on-line spray - hot melts
- ◆ Good tack at lower temperatures
- ◆ Longer service life - won't oxidize and decay (or embrittle as duct tape)
- ◆ Excellent low pour points
- ◆ Good "Slip and Slide", low to zero
- ◆ Working temp range -70°F to 800°F
- ◆ Cold flow - Pinhole plug
- ◆ Many grades low in color, transparent
- ◆ Stability, long life
- ◆ Wide range custom variations can be made for specific projects

Tirecycle™ Rubbers

The fundamental product is "a pre-cured, engineered, particulate elastomer with a coherent, homogeneous, reactive surface; ready to bond into any appropriate virgin rubber or masterbatch." *Tirecycle™* is *upcycled*, rejuvenated production waste or rubber crumb, performing as virgin replacement or equivalent. Made predominantly from tires, but EPDM, neoprene and many other rubbers and plastics will also work.

Typical production usage is: tire tread, hoses, grommets, shoe soles, conveyor belting, rubber sheet, mining and automotive components, agricultural equipment, etc. It is also used in waterproofing and roofing.

Contract Manufacturing

Custom Mixing, Liquefaction, Formulations. Low viscosity to very high viscosity. Toll Production. Packaging, Lab Work, Product Development, Testing.

For more information, view our website, call your distributor, or call 612-729-9153.

www.northstarelastomers.com

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NORST CUSTOM POLYMERS PROPERTIES CHART

POLYMER CHARACTERISTICS	PB 402-24	PB 403-34	PB 404-44	PB 400	PB 500	PB 600	PB 800	PB 4015	B 1620
VISCOSITY RANGE @ 350 °F	240,000-280,000 cps	240,000-280,000 cps	240,000-280,000 cps	50,000-55,000 cps	75,000-95,000 cps	100,000-120,000 cps	200,000-240,000 cps	30,000-50,000 cps	50,000-100,000 cps
MAXIMUM TEMPERATURE	+450°F	+650°F	+800°F	+450°F	+450°F	+450°F	+450°F	+450°F	+450°F
SOFTENING POINT				350°F+	350°F+	275°F+			350°F+
HARDNESS	Very Soft	Very Soft	Very Soft	Hard	Hard	Very Hard	Moderate	Hard	Hard
COLD FLOW	Yes to -70°F	Yes	Yes	No	No	No	No	No	No
FORM	Viscous Liquid	Viscous Liquid	Viscous Liquid	Block	Block	Block	Block	Block	Block
	100% solids								
	PIB polymer	PIB polymer	PIB polymer	Butyl ethylene propylene rubber base	Butyl ethylene propylene rubber base	Butyl ethylene propylene rubber base	Butyl compound	Butyl ethylene propylene rubber base	Butyl ethylene propylene rubber base
PACKAGING	45 lb Box 350 lb Drum	45 lb Box 350 lb Drum	45 lb Box 350 lb Drum	45 lb Box					
SPECIAL PACKAGING	25 lb Box Quick Release Box 50%-70% Solids	25 lb Box Quick Release Box 50%-70% Solids	25 lb Box Quick Release Box 50%-70% Solids	Quick Release Box 50%-70% Solids	Quick Release Box 50%-70% Solids	Crumb - 40 lb Box Quick Release Box 50%-70% Solids	Quick Release Box 50%-70% Solids	Quick Release Box 50%-70% Solids	Stick Cut Block Quick Release Box 50%-70% Solids
COMPATIBLE OTHER RESINS (avoid aromatic resins & polar solvents)	Y Aliphatic resins, oils, asphalts polybutenes rubbers, etc								
GOOD ELECTRICAL PROPERTIES	Y	Y	Y	Y	Y	Y	Y	Y	Y
RESISTANT TO WEATHERING	Y	Y	Y	Y	Y	Y	Y	Y	Y
WATERPROOF	Y	Y	Y	Y	Y	Y	Y	Y	Y
CHEMICAL RESISTANCE	compare to PIB								
Notes: Numbers relate to one another - 1 Lowest, 10 Highest Hardness per ASTM D-5-49									
NSE INTERNAL COMPARISON	PB 402-24	PB 403-34	PB 404-44	PB 400	PB 500	PB 600	PB 800	PB 4015	B 1620
VISCOSITY	5	6	7	2	2	3	5	2	2
SOFTENING POINT	1	1	2	5	8	7	10	5	5
TACK	10	10	10	2	4	6	7	9	2
ELASTICITY	10	10	10	4	7	6	10	9	5
STRENGTH	7	8	9	10	9	6	8	7	7
HARDNESS	2	2	2	7	8	10	6	8	8
COLOR	Lt Grey - Lt Amber	Lt Amber	Lt Amber	Grey - Amber	White - Lt Grey	Lt Grey - Lt Amber	Lt Amber - Lt Brown	White - Brown	Amber - Brown
TYPICAL USAGE	PB 402-24	PB 403-34	PB 404-44	PB 400	PB 500	PB 600	PB 800	PB 4015	B 1620
PSA	X	X	X	X			X	X	X
HOT MELT SEALANTS				X	X	X	X		
EXTRUDED SEALANTS	X	X	X	X				X	
PUMP GRADE SEALANTS	X	X	X	X				X	
ASPHALT MODIFICATION	X	X	X		X	X	X		X
BUTYL ADHESIVES	X	X	X	X					
HOT MELT ADHESIVES	X	X	X	X	X	X	X		X
MASTIC TAPE						X			
HOT MELT RUBBERS									X
PUMP GRADE BUTYL CAULKS								X	
PUMP GRADE BUTYL SEALANTS				X				X	

TIRECYCLE™ RUBBERS

NorthStar Elastomers, LLC, manufactures and markets several forms of *Tirecycle™*, for different purposes and markets. TC 1301 is an activating adhesive polymer, while TC 1302 for tires and MBS 800 for hoses are basic *Tirecycle™* compounds. All can be tested and adjusted for your specific master batch manufacturing and performance needs.

Tirecycle™ products are incorporated as a major functional part of new rubber/plastic products, not just dead filler as in current asphalt and playground applications, nor as air displacement in tire manufacture.

The *Tirecycle™* process converts used tires and other rubber wastes from an overwhelming environmental nuisance into a raw material with significant commercial value to the rubber and plastics industry in the manufacture of tire tread, many thermoset and thermoplastic compounds, etc. With billions of pounds of rubber in use every year, the tire industry is the biggest creator of waste rubber, and thereby has the greatest potential as a market for *Tirecycle™* treatment and treated crumb rubber.

Tirecycle Production from Activator

The production process (in our plant or at your production line) involves the application of a small percentage of *TC 1301* adhesive polymer to a large percentage of crumb rubber in a mixer (Banbury works best). The adhesive polymer, combined with the mixing process, serves to activate the previously "dead" particles of rubber crumb. At the completion of this stage, powdered or amorphous *Tirecycle™* products are bagged/boxed for shipment to the customer. This stream of *Tirecycle™* compound may be further processed with virgin synthetic or natural rubber compounds to produce a fully compounded sheet stock, which can be used directly in compression molding applications.

Tirecycle Application

Tirecycle™ products have proven to be a commercially viable and effective raw material in the manufacture of tire tread, hoses, molded mechanical items, floor tiles, roofing, plumbing parts, shoe outsoles, railroad crossings, automotive equipment, other injection molded and extruded polypropylene and polyethylene parts and miscellaneous items.

A typical application enables the user to incorporate as much as 30% to 75% of TC 1302 or MBS 800 into their rubber or plastic compound without significantly affecting the physical properties of the compound. Depending on the actual blend and concentration of *Tirecycle™* used, the compounder's raw material costs can be reduced by 20% to 50%. Use of *Tirecycle™* also enhances performance/wear of many high stress goods such as industrial and automotive v-belts, tires, footwear, etc, by increasing stability and traction (in particular on wet surfaces) and overall durability. *Tirecycle™* provides other significant manufacturing efficiencies (i.e, using about 1/3 less time to mix, mold, and cure rubber products such as tires – like adding a 4th shift to a 24/7 plant).

Typical Characteristics

	TC 1301	TC 1302	MBS 800
Form	Powder	Sand	Grain to chubby grain
Packaging	Melt bag	Melt bag, box, drum	Melt bag, box, drum
Weight	10-50 lbs	45 - 100 - 350 lbs	45 - 100 - 350 lbs

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TIRECYCLE™ BENEFITS

Economic Gain

Price: Minimum 10% to 15% below market for equivalent material.

Rejects: Dramatic air release improvement with unique "descorching" and anti-gel effects in obvious thick sections as well as complex smaller shapes (zero blisters). Noticeable improvement in flow and evenness of cure.

Output: Effective plant capacity increase from 30% to 50%

Markets: Often improved properties over 100% virgin compound can gain quickest form of profit: new customers, new market share and premium pricing. True post consumer recycle status can allow preferential access to many purchasers (federal mandates, regional programs and the environmentally motivated).

Production Process - At Compounding and Curing

Lower die swell: Greatly improved air venting. Elimination/reduction in blistering. Easier processing seen as lower hp/lb. Lower processing temperatures. Significantly faster and better cure (often 30% reduction in cure time).

Shorter mixing cycles: In the Banbury or on the mill. Often effective capacity increase of 50% occurs without need for additional capital equipment. No "warm up" mill needed - No knitting cycle required on slab/strip forms.

No bin scorch: On stored mill sheet (at over 4 weeks aging, inventory is safe, fresh). Big boost in "effective component distribution" of CB, sulfur, etc. Can "Unscorch" off-spec or overage virgin master batch. Improved reversion resistance and readily chemically blown to closed cell fine foams/sponge, at up to 30% void.

Finished Product - At the Customer

Improved wear resistance: Significantly, often 12-25% more life. Some truck treads over 30% reduction in abrasion loss in heavy road service. Conveyor belt in mining service has even doubled in life.

Reduced rolling resistance: Tires using at least 50% in the tread (significant fuel efficiency gains).

Cooler running tires: 30-40°F drop often noted - temperature has an exponential negative effect on rubber life. Decreasing hysteresis. Better wet and dry traction. Improved ozone and gas permeation, solvent and chemical resistance.

Better non-marking properties: Significant compression set resistance at wide range of durometers and heat aging improvement.

Observations of Mr. Edward Jakush (1946 - 2015), MIT graduate with over 40 years industrial experience, extensively wrote and recorded technical and business reports for nearly two decades. These are from his experience with compounders, manufacturers, end users and other third parties - participating in and recording numerous customer reported lab tests, initial plant production and field trials of *Tirecycle™* at levels of 33% to 87% in broad commercial applications.

NorthStar Elastomers, LLC

Learn more at nselastomers.com