

New PA66 Feedstock Resins

Essential building blocks for world-class PA66 compounds

Ascend Performance Materials® launches new grades of PA66 feedstock resin and leads the industry with a robust and high-quality portfolio of compounding solutions.



www.ascendmaterials.com

About Ascend Performance Materials

Ascend is a leading global provider of PA66 resin and compounds. Its fully integrated manufacturing assets are strategically located in the southeastern U.S., having close proximity to major sources of energy and key chemical feedstocks, as well as easy access to sea ports to enable global trade. Ascend produces PA66 resin in Pensacola, Fla., and in Greenwood, S.C. Since 2005, Ascend has more than doubled its PA66 resin capacity, primarily in Pensacola, making it the largest PA66 resin producer in the world.

For many years, Ascend has been a leader in the supply of PA66 feedstock resin to independent compounders. Over the past year, Ascend has introduced several new resin solutions to meet the ever-increasing demand for more productive, functional and aesthetically-neutral compounding feedstock.

Compounding PA66 Feedstock

PA66 is a semi-crystalline polymer with a melting temperature around 260° C. It absorbs moisture easily—hydrophilic in nature. Compared to other resins, compounding with PA66 requires higher temperatures and drying with a vacuum finish to a moisture level below 0.2 percent in the extruder. The viscosity change as a function of moisture concentration in the PA66 melt is shown in Figure 1.

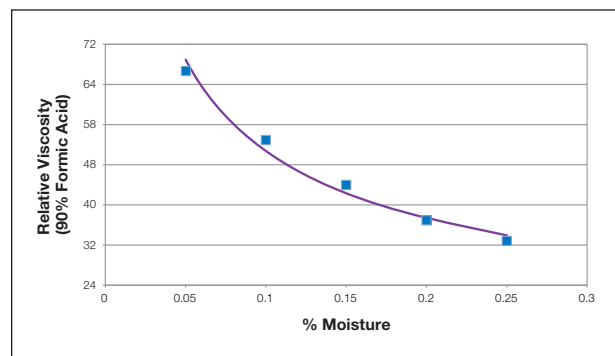


Figure 1: Relative viscosity (90 percent Formic Acid—ASTM D789) change with percentage moisture in the melt (Product: 50BWFS, pellet relative viscosity: 48).

PA66 is typically compounded with additives to enhance its strength, stiffness, toughness, thermal conductivity, dimensional stability, creep resistance and FR properties. Most common additive systems include reinforcing fibers, inorganic fillers, impact modifiers, flame retardants and coloring pigments. Typical additive concentration ranges from 5 to 50 percent, while some applications require up to 70 percent additive levels.

Compounding with additives requires a homogenous final mixture in order to reach the optimal balance of the desired properties. Best results are achieved when the additives are integrated into the PA66 matrix during the compounding process. This can be obtained by selecting the right PA66 feedstock resin and combining it with the desired additive package required for the application. The most commonly used additives are surface-modified to increase the compatibilization with PA66. It is well known that aminosilane coupling agents used on glass-fiber surfaces and maleic anhydride functionalized rubber particles promote mixing with the PA66 matrix. However dispersive and distributive mixing of these additives can only be achieved with the correct molecular weight and end-group balance of PA66 resin.

The flow behavior of the final compounded resin is critical for the injection-molding process. Viscosity of the feedstock as well as the concentration and type of additive (rubber particles) may reduce the flow of the compounded product resulting in challenges during the molding operation. Melt Flow Index measured according to ASTM D1238 is typically used to characterize the flowability of PA66 feedstock and compounded resin. MFI is an indirect measure of viscosity, with high melt-flow index corresponding to low viscosity. MFI change as a function of relative viscosity of PA66 is shown in Figure 2.

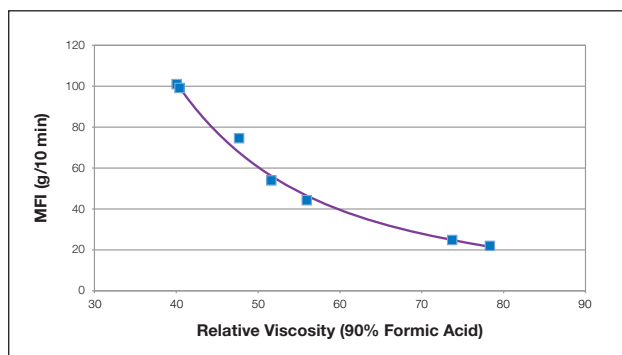


Figure 2: MFI (g/10 min) measured at 275° C, 2.16 kg, five-minute hold time at 0.05 percent water (ASTM D1238) vs. relative viscosity (90 percent Formic Acid—ASTM D789) for neat PA66.

MFI measurements are easy to conduct in a laboratory, and they require only a small amount of sample material. MFI can be used as a quality tool to run batch-to-batch comparisons or incoming raw material certification. However, care has to be taken with MFI measurements of PA66 resins due to their sensitivity to moisture. The viscosity of PA66 resin will change in the melt depending on the moisture level as shown in Figure 1. Since MFI changes with relative viscosity (Figure 2), it also changes with moisture. The moisture dependence of MFI is exhibited with Vydne® 50BWFS feedstock in Figure 3.

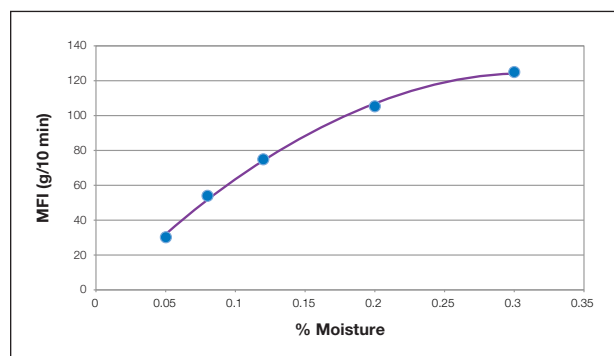


Figure 3: MFI (g/10 min; measured at 275° C, 2.16 kg, five-minute hold time, ASTM D1238) change with percentage moisture in the melt (Product: Vydne 50BWFS, pellet relative viscosity: 48).

Key Quality Attributes

Ascend's unique polymerization process offers the following benefits critical to the productivity and functionality of compounding feedstock:

- Precise molecular weight-viscosity control
- Optimized balance of end groups to enable mixing and flow
- Low yellowness index for natural color products
- Uniform distribution of size and shape of pellets (1.5 gr/100 pellets) to promote consistent feeding, melting and creation of a homogenous final product
- Low black speck (less than 1 mm) count less than or equal to 5 ppm

Ascend's feedstock product portfolio consists of resin grades with various levels of viscosity, moisture and yellowness index options to enable customers to find the right product for desired applications. The high quality of Ascend's resins provides opportunities for reduced downtime, improved throughput and quality control cost savings in the extrusion process.

Product Descriptions

Feedstock grades are formulated individually to obtain the optimal balance between desired mixing level and integration of additives to the PA66 backbone without sacrificing the flow characteristics and mechanical properties needed for the final application.

Lower viscosity resins, 21LS and 21ZLV, enable mixing shear-sensitive materials and high-concentration fillers where distributive mixing is essential to the performance of the final product. The compounded product will maintain its high flow and performance needed for the application.

Medium- and high-viscosity grades (21MST, 21Z-NT01A2, 21Z, 50BW, 21FS-R and 52BW-MS) provide dispersive mixing, which breaks up large particles and disperses them as smaller particles throughout the melt. This distributive shear process improves mixing effectiveness of additives without causing PA66 to degrade. The new 21Z-NT01A2 grade is unique in its class with its high concentration of amine end groups that is proven to be an advantage for moisture-sensitive formulations. Also, the new grade, 21MST, provides excellent melt-viscosity stability against moisture throughout the extrusion process.

Ascend's Portfolio of PA66 Compounding Feedstock Resins

Category	Product Characteristics	Relative Viscosity	AEG	Moisture	Yellowness Index
Low-Viscosity Resins	21ZLV Low-viscosity resin designed for reactive compounding formulas	35	52	<0.35	<1
	21LS NEW Low-viscosity resin designed for high-flow applications	35		<0.5	<1
Medium-Viscosity Resins	21MST NEW Excellent viscosity stability during compounding	43		<0.5	<1
	21Z Medium-viscosity resin, general purpose	46		<0.5	<2
	21Z-NT01A2 NEW High amine end group functionalized, medium viscosity	44	77	<0.5	<2
	50BW Lowest YI and moisture, medium-viscosity resin	48		<0.2	<-4
	50BWFS Lowest YI, medium-viscosity resin	48		<0.5	<-4
High-Viscosity Resins	21FSR Medium- to high-viscosity resin	52		<0.5	<2
	52BWMS NEW Lowest YI, medium- to high-viscosity resin	52		<0.35	<-4
	63A High-viscosity resin for improved melt strength	80		<0.1	<1
	65B NEW High-viscosity resin for improved melt strength	130		<0.1	<1

Ascend's Portfolio of PA66/6 Compounding Feedstock Resins

Ascend produces medium-viscosity PA66/6 random copolymers (88X, 85XFS and 86XFS) for compounds containing heat-sensitive additives and end-use applications that require good surface finish. These copolymer resins have melt temperatures varying from 240° to 255° C based on the comonomer concentration. The reaction of caprolactam with adipic acid-HMD produces lower melt temperature polyamide resin without reducing its crystallinity.

The random copolymers are shown to be more effective than pellet blending with PA6 in reducing the melt temperature without decreasing the desired mechanical properties. These copolymers are specifically designed to be used with FR packages and high mineral loadings. The new 88X is the product of choice for applications requiring low yellowness.

Category	Product Characteristics	Relative Viscosity	T _m (°C)	Moisture	Yellowness Index
Medium-Viscosity Copolymers	85XFS General purpose, good surface finish, higher toughness	48	245	<0.5	<1
	86XFS Lowest melt temperature copolymer, increased elongation	48	240	<0.5	<1
	88X NEW Lowest YI copolymer with good surface finish	48	255	<0.5	<-4

Focus on Product Quality

Ascend's intense focus on quality, service and reliability starts with product integrity. Our continuing investments in technology and assets enable us to deliver best-in-class consistency in our products. Furthermore, pure adipic acid and hexamethylenediamine are continuously polymerized in large-scale units using state-of-the-art online process analytics. The resulting Vydne PA66 feedstock grades lead the industry with consistency in key quality attributes important to compounders. Ascend is able to control viscosity within two percent of target values and amine end groups within three percent of target values.

Conclusion

Ascend is a leader in the supply of PA66 feedstock resin to independent compounders. Over the past year, Ascend has significantly expanded its compounding portfolio with six new resin solutions to meet unique combination of customer needs—new additive systems, higher concentration and higher process productivity.

Ascend is committed to bringing innovative and high-quality products to independent compounders of PA66.

Please contact your local Ascend sales representative for additional information and to arrange a sample.

North America

600 Travis Street, Suite 300
Houston, TX 77002
USA

+1 713 315 5700

Europe

Watson & Crick Hill Park
11, rue Granbonpré - Bâtiment H
B-1435 Mont-St-Guibert
Belgium

+32 10 60 8600

Asia

Unit 3602, Raffles City
No. 268, Xizang Road (M),
Shanghai, China 200001

+86 21 6340 3300

Find more information or contact us at www.ascendmaterials.com

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