

AP Nylon Composites Portfolio Overview

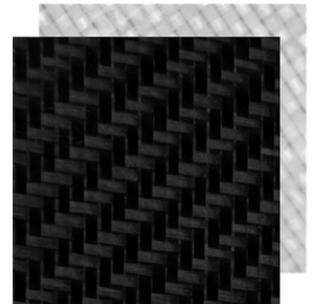
Nylon 6 Composite Sheets

JM Advanced Composites

Johns Manville, a leading provider of glass fiber reinforcements, has developed an innovative process for producing of AP nylon composite sheets. The new proprietary technology is based on anionically polymerized polyamide-6 (AP nylon) and fiber reinforcements (glass fiber, carbon fiber or hybrids).

AP Nylon Technology Platform

JM's expertise in glass fiber manufacturing and in-depth understanding of fiber-polymer interfaces in composites led to the development of a pioneering manufacturing technology to produce fully impregnated nylon 6 composite sheets. The proprietary technology, covered by multiple U.S. and foreign patents, is versatile in terms of reinforcing materials and can be used to impregnate glass, carbon, aramid and hybrid reinforcements. Nylon 6 composite sheets are produced in a continuous process through the impregnation of fiber reinforcements with low viscosity caprolactam monomer, followed by the *in situ* anionic polymerization of caprolactam to form the thermoplastic polyamide matrix.



AP Nylon Composites Portfolio and Key Attributes

JM has created a portfolio of nylon 6 thermoplastic composite sheets that offer a wide range of material solutions. The product portfolio includes:

- **OS-6 Series** – nylon 6 organosheets based on woven fabrics
- **CR-6 Series** – nylon 6 composite sheets based on chopped fiber reinforcement
- **NCF-6 Series** – nylon 6 composite sheets based on non-crimp fabrics

	OS-6 Series	CR-6 Series	NCF-6 Series
Resin	Nylon 6	Nylon 6	Nylon 6
Fibers*	Continuous, woven	Chopped roving	Continuous, non-crimp
Strength	...	..	....
Stiffness	....	...	....
Impact Resistance	....	...	....
Formability	..	....	...

Advantages of JM AP Nylon Composites over other Thermoplastic Composite Sheets

The new JM advanced composites are produced through impregnation and *in situ* polymerization of caprolactam, a very low viscosity monomer. This leads to:

- lower cost
- complete impregnation of complex fabrics
- ultra-low void composites
- high molecular weight nylon 6 due to anionic polymerization of caprolactam

Applications and Processing



JM's nylon 6 composite sheets are ideal for applications requiring:

- light-weighting
- part integration
- design flexibility
- high volume composite manufacturing
- short cycle time
- recyclability

OS-6 series and NCF-6 series products are ideal for hybrid molding processes such as injection and compression overmolding. CR-6 series products are excellent for thermoforming, stamping, and other compression applications.

<p>Brake pedal Applications: <i>automotive</i> Material: OS-6 Series Process: overmolding</p> 	<p>Pipe segment Applications: pipes, storage Material: OS-6 Series Process: winding</p> 	<p>Seat pan Applications: automotive Material: CR-6 Series Process: stamping</p> 	<p>Rear differential cover Application: automotive Material: NCF-6 Series Process: press forming</p> 
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Samples

Johns Manville Composites in the OS-6, CR-6, and NCF-6 series are semi-finished sheets. Samples, including cut-to-shape sheets, are available upon request. Wider sheets (1.5 meter) will be available for evaluation in early 2020.

About JM

Johns Manville, a Berkshire Hathaway company (NYSE: BRK.A, BRK.B), is a leading manufacturer and marketer of premium-quality building and specialty products. In business since 1858, the Denver-based company has annual sales of \$3 billion and holds leadership positions in all the key markets that it serves. Johns Manville employs 7,500 people and operates 43 manufacturing facilities in North America, Europe and China.

Additional information can be found at www.jm.com.

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