

3M™ Matrix Resins
for Pultruded Composites



A higher level of
performance.

Stronger, lighter, tougher composites.





3M™ Matrix Resins

Rewriting the rules

for pultruded
composites.

It's time to rethink what you thought you knew about composite performance. Revolutionary 3M™ Matrix Resins are rewriting the rulebook. The first thermosetting resin systems to successfully incorporate silica nanoparticles, 3M matrix resins are proven to increase the strength, toughness and durability of composites, while also reducing weight.

A shear breakthrough.

The key to the performance of 3M matrix resins is their incredibly high shear modulus—65% higher than typical epoxy resins. This allows the resin to compensate for one of the primary weaknesses of carbon fiber composites—their relatively low compression strength, which can limit your design options and lead to micro-buckling in the finished product. 3M matrix resins, with their highly uniform dispersions of nanoparticles, literally form a molecular support system for each individual carbon fiber, reducing or delaying micro-buckling and significantly increasing fracture toughness. The resulting composites feature:

- higher in-plane shear modulus
- higher interlaminar shear strength
- higher flexural strength
- higher compression strength

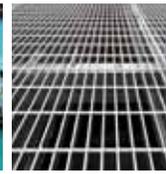
New market opportunities.

Now you can use composites for products that were impossible to make with ordinary pultrusion resins.

- 3M™ Matrix Resin 5831 is a high performance product that provides improved mechanical properties as well as process improvements.
- 3M™ Matrix Resin 5832 is designed to be used as a small-ratio additive for reducing pull force and improving productivity (faster line speeds and higher fiber volume).



The illustration at left shows the size relationship between a typical carbon fiber and 3M's silica nanoparticles. 3M scientists have found a way to create exceptionally uniform dispersions of nanoparticles in epoxy resins, significantly improving both shear modulus *and* fracture toughness, while preserving cure properties.



Improving composites on almost every measure of performance.

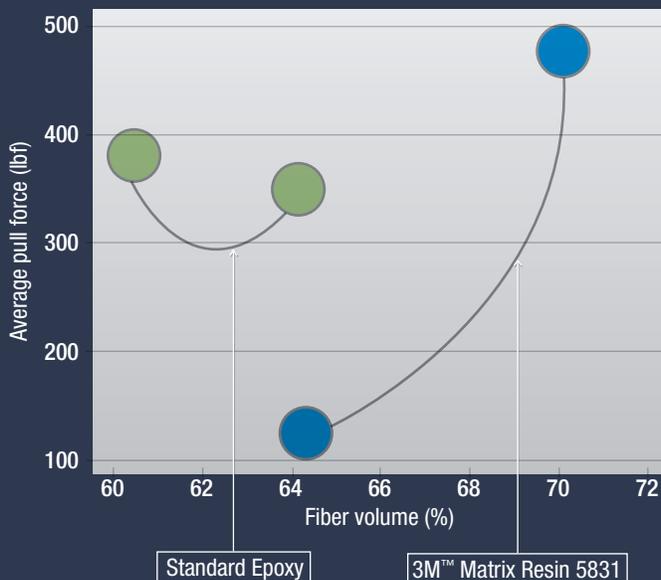
- less pull force
- less exotherm
- more fiber volume
- less shrinkage
- greater hardness

Improving your processing, too.

Surprisingly, the same advanced properties that improve composite performance with 3M Matrix Resins help make pultrusion processing easier, as well. In fact, 3M Matrix Resins have been shown to reduce the pull force in pultrusion processing by more than 60% while completely eliminating the need for mold release. This means:

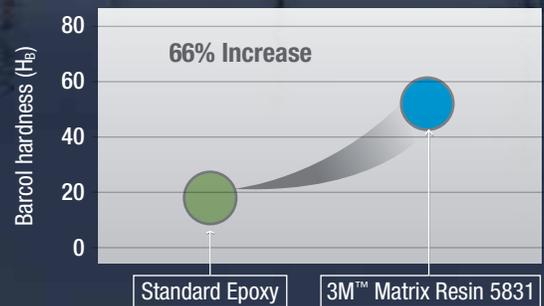
- less downtime
- higher line speeds
- greater productivity
- easier restarts
- more complex or intricate products
- greater carbon fiber volume

Less force, more fiber



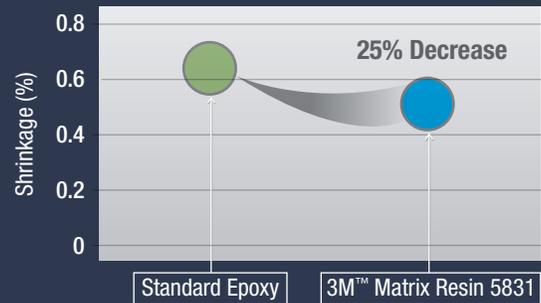
Pull force reduction enables higher fiber volume.

Greater hardness



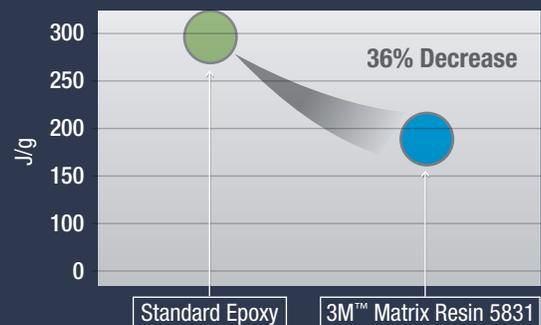
Neat resin castings made with Bis-A epoxy cured with anhydride curative.

Less shrinkage



ASTM D2566 cured at 9°C for 2 hours followed by 150°C for 2 hours.

Less exotherm



ASTM D2566 cured at 9°C for 2 hours followed by 150°C for 2 hours.

Another ingenious solution from a world leader in nanotechnologies and specialty materials.

With 45 technology platforms and a culture of continuous innovation, 3M is known around the world for creating practical and ingenious solutions for almost every sphere of life. 3M™ Matrix Resins, which leverage 3M expertise in specialty materials, dispersion processing and nanotechnology, are one of our latest breakthroughs. These advanced resins drop right in to your current processes and allow you to make composites that are substantially stronger, lighter and more durable than anything else on the market today.

3M™ Matrix Resin properties

Resin Properties	Standard Bis-A Epoxy	3M™ Matrix Resin 5831
K_{IC} (Mpa√m)	1.16	1.74
T_g (°C) by DSC	131	123
Tensile Modulus, E (ksi)	439	708
Peak Tensile Stress (ksi)	11.3	11.7
% Elongation at Yield	5	3
Viscosity at 25°C (Pa*s)	1.6	3.5

Note: All samples cured with Lindau Chemicals' Lindride LS5IK.

Pultruded profile properties

	Units	Standard Epoxy Resin	3M™ Matrix Resin 5831	3M™ Matrix Resin 5832
Fiber Volume		64.3%	70.5%	64.3%
		68.4%	64.3%	70.5%
Pull Force				
	lbs	345	*	158
		325	135	463
Short Beam Shear				
Peak Shear Stress	ksi	11.8	*	13.8
		13.9	11.7	12.5
3-Point Bend				
Flex Failure Stress	ksi	232	*	258
		265	218	239
Flex Failure Modulus	msi	20.5	*	20.1
		21.2	20.0	21.8

*Not possible with standard epoxy resin.

3M™ Matrix Resins perform significantly better than standard epoxies on a wide range of important measures.

Start making your composites stronger, lighter and tougher. Find out more at 3M.com/advancedcomposites or call 1-800-362-3550.

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Note: Neat resins cured with Lindride LS8IK. The technical information and data should be considered representative only and should not be used for specification purposes.



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