3M Science. Applied to Life.™

3M™ Nextel™ 610 Spread Tow and Spread Tow Fabrics

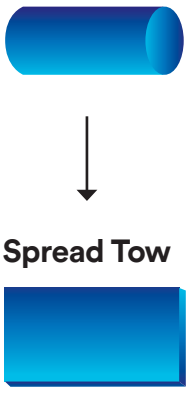
Experimental Product

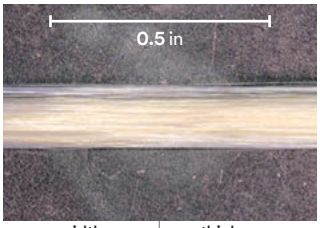
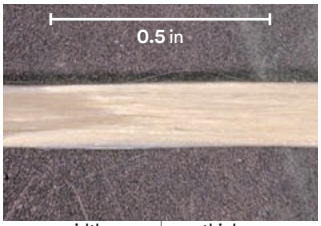
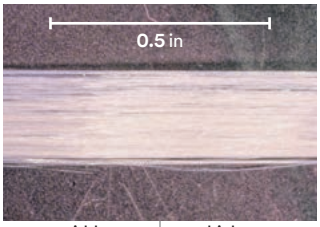
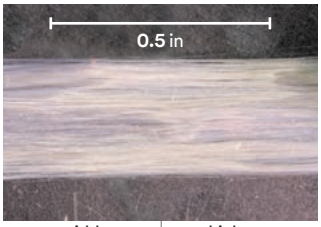
Overview

Oxide-oxide ceramic matrix composites (Ox-Ox CMCs) enable aircraft to operate more efficiently, through hotter engine temperatures and lower weight materials relative to existing metallic parts. The majority of these composites are based on 1,500 denier fabrics of either 3M™ Nextel™ 610 or 720 continuous filament ceramic oxide fibers. 3M has developed higher denier fabrics that deliver equivalent performance to 1,500 denier fabrics at a lower price. More recently, 3M has developed spread tow versions of 10,000 and 20,000 denier Nextel 610 and 720 ceramic oxide fibers. These products enable, for the first time, a viable input for automated composite processing of Ox-Ox CMCs, as well as spread tow fabrics with unique combinations of denier and fabric thickness. 3M™ Nextel™ Spread Tow and Spread Tow Fabrics can also be used in Polymer Matrix Composites (PMC) and Metal Matrix Composites (MMC).

Properties

3M™ Nextel™ 610 Spread Tow is available in 10,000 and 20,000 deniers (g/9,000 m). The included table compares the width and thickness of the spread tow. Note that these are 30-40% less thick than standard high denier Nextel rovings, making them comparable to 3M™ Nextel™ 610 DF-11 Fabric thicknesses and an attractive input for automated composite layups. In addition, the Nextel Spread Tow products are sized with a water soluble sizing that is compatible with water based ceramic slurries and also provides excellent tow bundling and flexibility. This eliminates the need for heat cleaning (sizing removal) prior to infiltration. Sizing chemistries currently available include polyvinylpyrrolidone (PVP), polyvinyl alcohol (PVA), polyethylene glycol (PEG), polyethylene oxide (PEO), and copolymers/blends of these.



	10,000 denier		20,000 denier	
				
	width	thickness	width	thickness
Elliptical Tow	3.8 mm (0.15")	0.18 mm (7.0 mil)	3.8 mm (0.15")	0.27 mm (10.7 mil)
				
	width	thickness	width	thickness
Spread Tow	7.6 mm (0.30")	0.10 mm (4.0 mil)	12.7 mm (0.50")	0.19 mm (7.6 mil)

Width and thickness are nominal and not for specification purposes. Thickness was measured under 0.6 psi with a pressure foot gauge.

Product	Denier (g/9000m)	Width (mm)	Thickness (mm)	Sizing
3M™ Nextel™ 610 10,000 Denier Spread Tow	10,000	7.6	0.10	water soluble
3M™ Nextel™ 610 20,000 Denier Spread Tow	20,000	12.7	0.20	water soluble

Width and thickness are nominal and not for specification purposes.
Width, thickness, and sizing can be modified for specific applications.

Spread tow fabrics

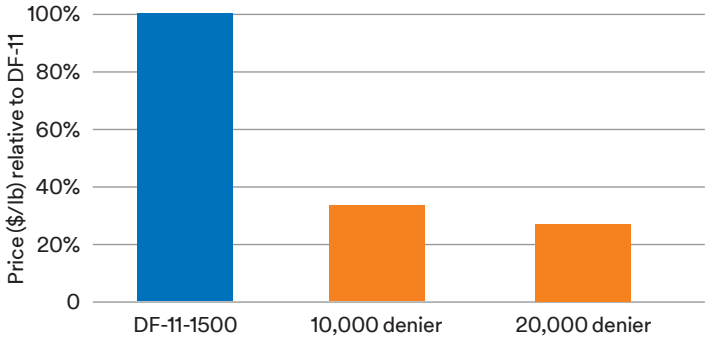
3M™ Nextel™ 610 Spread Tow is also available as a fabric, in both a plain weave and 2×2 twill weave. The included table compares properties of these two fabrics relative to the 3M™ Nextel™ 610 DF-11 Fabric. Note that the Nextel Spread Tow fabrics offer similar thicknesses to the DF-11 fabric, but lower areal densities, providing greater design flexibility in the composite layup. The Nextel Spread Tow that is used to weave the fabrics has the same water soluble sizing options that are described above, eliminating the need for heat cleaning (sizing removal) prior to infiltration with the ceramic slurry during composite layup.

Fabric	DF-11	Experimental	Experimental
Fiber	Nextel 610	Nextel 610	Nextel 610
Denier (g/9000 m)	1,500	10,000	10,000
Weave	8HS	Plain	2×2 Twill
Areal Density gsm (oz/in²)	370 (10.9)	280 (8.3)	280 (8.3)
Thickness µm(mil)	254 (10.3)	262 (10.3)	267 (10.5)

Fabric properties are not for specification purposes.

Pricing

Nextel 610 Spread Tow offers significant cost savings over comparable inputs for a CMC application such as DF-11 fabrics. This chart estimates the relative price difference between a DF-11 fabric and Nextel 610 10,000 Denier and 20,000 Denier Spread Tow.



Contact

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