

3M Advanced Materials Division

# 3M™ Nextel™ Ceramic Rovings, Yarns, and Chopped Fibers 312 and 440

## Introduction

3M™ Nextel™ Ceramic Rovings, Yarns, and Chopped Fibers 312 and 440 are made from continuous Nextel Alumina-Boria-Silica fibers and are designed for high temperature applications where their primary purpose is to insulate or to act as a flame barrier. They can also be used as a reinforcement in ceramic and polymer composite applications.

Nextel ceramic rovings, yarns, and chopped fibers 312 retain strength at continuous temperatures of up to 2192°F (1200°C). Nextel ceramic rovings and plied yarns 440 retain strength at continuous temperatures of up to 2372°F (1300°C).

**Rovings** are a loose assemblage of fibers in a single strand without twists. **Yarns** are an assembly of strands twisted together. **Chopped fibers** are short lengths of roving strands cut uniformly in length.

Due to the presence of B<sub>2</sub>O<sub>3</sub>, Nextel ceramic fibers 312 and 440 have both crystalline and glassy phases. The glassy phase helps the fiber to retain its strength after exposure to high temperature because it slows the growth of the crystalline phases that weaken the fiber. However, when the fiber is stressed at high temperature, the glassy phase weakens the fiber due to viscous flow.

## Typical Applications

Application	3M™ Nextel™ Ceramic Rovings, Yarns, and Chopped Fibers	
	312	440
Continuous Use Temperature*	2192°F (1200°C)	2372°F (1300°C)
<b>Aerospace</b> Flame barrier, thermal shields, gaskets, seals, micrometeorite debris shields		
<b>Industrial</b> Furnace curtains and linings, door seals, tube seals, gaskets, expansion joints, flexible couplings		
<b>Composites</b> Ceramic Matrix Composites (CMC), Polymer Matrix Composites (PMC)		
<b>Electrical</b> Heater wire insulation, thermocouple insulation		

\*40% fiber strength retention tested at room temperature after 100 hours soak.

## Features and Benefits

- Non-oxidizing
- Non-hygroscopic
- Good chemical resistance
- Low thermal conductivity
- Good abrasion resistance
- Fire and flame resistant

## Important Processing Information

**Sizing:** Sizing is a processing aid applied to rovings and yarns to provide lubricity and binding action to protect the fibers and assist in handling. When first heated, the sizing may ignite and/or decompose to potentially hazardous byproducts or process contaminants. See Safety Data Sheet or contact 3M for more information.

Nextel ceramic rovings 312 are treated with 299 sizing which is composed of polyvinyl alcohol (PVA) and other additives, and have a white color.

222 sizing is a proprietary inorganic coating and may be useful in applications where it is undesirable to heat clean the product to remove organic coatings.

Nextel ceramic rovings 440 are treated with 300 sizing which is composed of polyvinyl alcohol (PVA) and other additives, and have a coral color. Nextel ceramic rovings 440 may also be treated with an epoxy resin sizing upon request.

A pigment has been added to some of the sizing chemistry of some products to aid in identification.

## Typical Properties (not for specification purposes)

### 3M™ Nextel™ Ceramic Roving 312

Roving	Nominal Filament Count	Yield		Breaking Load*	
		yds/lb	m/kg	lbs	kg
600 denier (67 tex)	400	7400	15000	6	2.7
900 denier (100 tex)	400	4900	9800	8	3.6
1200 denier (133 tex)	750	3600	7300	14	6.4
1800 denier (200 tex)	750	2400	4900	16	7.3
3600 denier (400 tex)	1375	1200	2400	30	14

### 3M™ Nextel™ Ceramic Served Roving 312

Roving	Nominal Filament Count	Yield		Breaking Load*	
		yds/lb	m/kg	lbs	kg
600 denier (67 tex)	400	6300	13000	7	3.2
900 denier (100 tex)	400	4300	8700	10	4.5

### 3M™ Nextel™ Ceramic Roving 440

Roving	Nominal Filament Count	Yield		Breaking Load*	
		yds/lb	m/kg	lbs	kg
1000 denier (111 tex)	400	4400	8800	10	4.5
2000 denier (222 tex)	750	2200	4400	18	8.2

### 3M™ Nextel™ Ceramic Yarn 312

Yarn	Ends	Diameter		Yield		Breaking Load*	
		in	mm	yds/lb	m/kg	lbs	kg
<b>600 denier (67 tex) 1.5 Twists/inch (59 Twists/m)**</b>							
1/2	2	0.007	0.18	3590	7240	13	5.9
<b>900 denier (100 tex) 1.5 Twists/inch (59 Twists/m)**</b>							
1/2	2	0.008	0.20	2370	4780	19	8.6
<b>900 denier (100 tex) 2.7 Twists/inch (106 Twists/m)**</b>							
1/2	2	0.009	0.23	2370	4780	19	8.6
1/3	3	0.013	0.33	1580	3190	28	13
1/5	5	0.018	0.46	950	1920	44	20
2/3	6	0.022	0.56	780	1570	50	23
3/4	12	0.034	0.86	390	790	100	45
4/5	20	0.048	1.22	230	460	150	68
3/8	24	0.052	1.32	195	390	130	59
<b>900 denier (100 tex) 4.0 Twists/inch (157 Twists/m)**</b>							
1/2	2	0.010	0.25	2370	4780	20	9.1
4/5	20	0.052	1.32	230	460	130	59
<b>1800 denier (200 tex) 0.5 Twists/inch (20 Twists/m)**</b>							
1/2	2	0.009	0.23	1180	2380	32	15
<b>1800 denier (200 tex) 2.7 Twists/inch (106 Twists/m)**</b>							
1/2	2	0.016	0.41	1180	2380	33	15
1/3	3	0.020	0.51	780	1570	43	20
1/4	4	0.025	0.64	590	1190	64	29
2/3	6	0.033	0.84	390	790	91	41
2/5	10	0.047	1.19	230	460	150	68
2/6	12	0.054	1.37	195	390	150	68
<b>1800 denier (200 tex) 4.0 Twists/inch (157 Twists/m)**</b>							
1/2	2	0.018	0.46	1180	2380	33	15

Note: Yields and breaking loads are based upon sized rovings and yarns. An inorganic sizing is available on any 900 denier or 1800 denier Nextel Plied Yarn 312.

\* Tested at room temperature.

\*\* Other twist levels available.

## Typical Properties (not for specification purposes) (cont.)

### 3M™ Nextel™ Ceramic Yarn 312 with 222 Sizing

Yarn	Ends	Diameter		Yield		Breaking Load*	
		in	mm	yds/lb	m/kg	lbs	kg
<b>900 denier (100 tex) 2.7 Twists/inch (106 Twists/m)**</b>							
1/4	4	0.014	0.36	1180	2380	27	12
<b>3600 denier (400 tex) 2.7 Twists/inch (106 Twists/m)**</b>							
2/5	10	0.073	1.85	110	220	160	73

### 3M™ Nextel™ Ceramic Yarn 440

Yarn	Ends	Diameter		Yield		Breaking Load*	
		in	mm	yds/lb	m/kg	lbs	kg
<b>1000 denier (111 tex) 2.7 Twists/inch (106 Twists/m)**</b>							
1/2	2	0.009	0.23	2150	4330	20	9.1
2/2	4	0.015	0.38	1070	2160	33	15
3/4	12	0.034	0.86	350	710	82	37
4/5	20	0.050	1.27	192	433	150	68
<b>2000 denier (222 tex) 1.5 Twists/inch (59 Twists/m)**</b>							
1/2	2	0.012	0.30	1065	2150	36	16
<b>2000 denier (222 tex) 2.7 Twists/inch (106 Twists/m)**</b>							
1/2	2	0.015	0.38	1065	2150	33	15
2/5	10	0.046	1.2	210	420	110	50

Note: All yields are based upon sized rovings and yarns.

\* Tested at room temperature.

\*\* Other twist levels available.

### 3M™ Nextel™ Ceramic Chopped Fibers 312

Nextel ceramic rovings may be chopped to specified length. The following table lists standard fibers and lengths. Other fibers and lengths may be chopped by special request.

Fiber	Cut Length	
	in	mm
Nextel 312	1/8	3.2
	1/4	6.4
	1/2	12.7

## Additional Information

For additional information about 3M™ Nextel™ Ceramic Rovings, Yarns, and Chopped Fibers 312 and 440, please call 1-800-367-8905, or contact your local 3M representative.

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98-0050-0357-3