

Kevlar® RTP Better Reinforcement for Thermoplastic Resins

New KEVLAR® RTP

KEVLAR® para-aramid fibers have long been used in a wide variety of demanding applications because of an impressive list of physical and thermal properties. KEVLAR® combines high tensile strength (5 times that of steel on an equal weight basis), high modulus, and low elongation to break with excellent wear properties, temperature stability and chemical resistance.

KEVLAR® excellent wear resistance has led to broad industry adoption of short fibers in brakes and clutches, as well as elastomer matrices.

In order to further take advantage of these properties, DuPont has developed new KEVLAR® short fibre concentrates that open new design options for demanding applications in the plastic reinforcement industry: KEVLAR® RTP.

KEVLAR® RTP is a 6 mm concentrate pellet containing a proportion of KEVLAR® and thermoplastic resin. KEVLAR® RTP can be injection molded



as-is or “letdown” with other compatible thermoplastic pellets.

The inclusion of KEVLAR® para-aramid into a molded or extruded part can offer significant performance advantages versus neat resins or traditional glass reinforcements including:

- ❑ superior wear resistance (with higher pressure/velocity limits).
- ❑ virtually no abrasion to counter surface.
- ❑ improved mechanical and thermal properties.

Due to its non-abrasive nature, KEVLAR® RTP is also easier on processing equipment and simplifies the machining of parts.

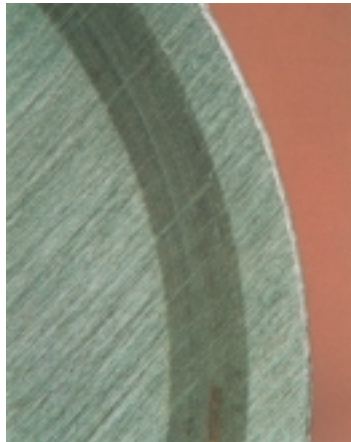
Engineering Fiber Systems

Superior Wear Performance vs. Glass

Chopped or milled glass fibers are popular forms of reinforcement for conventional engineered thermoplastics.

While glass will improve physical properties, it is an extremely abrasive fibre that can readily damage counter wear surfaces.

The figure below illustrates this effect. The steel washer weight loss is representative of the abrasive nature of the plastic part on the counter surface. A low level of KEVLAR® RTP, however, reduces the plastic wear factor, the coefficient of friction and the wear to the counter surface. The photographs illustrate the reduced counter surface abrasion using KEVLAR® fibers versus glass.



Nylon reinforced with KEVLAR® produces almost no galling on the steel counter surface.



Glass-filled nylon has high/abrasive effect on this finished steel washer surface.

Processing

KEVLAR® RTP concentrates can be processed on standard injection molding equipment with slight processing set-up modification.

Optimal molding conditions have been established for each resin type.

Molded parts are easy to machine and are much more gentle on cutting tools, increasing tool life.

Wear Resistance of Thermoplastics reinforced with KEVLAR® RTP**

Properties	Wear Factor (mm ³ /Nm x 10 ⁻⁶)	Friction Coefficient	Steel Washer wt-loss (mg)	Wear Rate cm/hr x 10 ⁻⁵
ZYTEL® * 103 ^a	18.5	0.435	0.2	58.2
33%wt. Glass fibre	8.5	0.420	0.4	26.9
20% wt. KEVLAR®	4.8	0.390	<0.01	15.2

(ASTM D3702-78, P=1 .72 MPa, v= 3m/mm.)

a : unreinforced

Superior Wear Resistance

KEVLAR® RTP is also an efficient reinforcing material. The figure illustrates the wear performance of ZYTEL® 103 and HYTREL® 5526 resins reinforced with various levels of KEVLAR® fibers. Even at low levels, KEVLAR® RTP greatly improves the wear performance of both resins. The photographs below show the reduced part wear realized when the resin reinforced with KEVLAR® RTP is compared to the neat nylon resin.

Wear Performance of ZYTEL® and HYTREL® resins reinforced with Kevlar® RTP

Properties	Wear Factor (mm ³ /Nmx10 ⁻⁶)	Friction coefficient	Steel Washer wt. Loss (mg)
ZYTEL® 103 HS	18.5	0.44	0.2
w/5% KEVLAR®	9.0	0.46	<0.01
w/17.5% KEVLAR®	4.8	0.42	<0.01
HYTREL® 5526	847	0.77	-
w/ 5% KEVLAR®	1.37	0.81	-
w/ 10% KEVLAR®	2.26	0.68	0.7
w/ 15% KEVLAR®	1.47	0.61	-



Unreinforced ZYTEL® resulted in a wear factor of 18.5 -wearing 4X faster than parts reinforced with KEVLAR® RTP.



ZYTEL® reinforced with KEVLAR® RTP resulted in a wear factor of 4.8.

Mechanical Property Improvements

Thermoplastic resins reinforced with KEVLAR® RTP also offer improved mechanical properties as shown in the figure.

Of specific interest is the higher heat deflection temperature and increased modulus and flexural properties.

Mechanical Properties of Kevlar reinforced ZYTEL and HYTREL resins*				
Properties	ZYTEL 103 HS Neat Resin	17.5% KEVLAR® resin	HYTREL 5526 Neat Resin	10.0% KEVLAR®
Tensile strength (MPa)ASTMD638	82.7	119.28	32.13	32.06
Tensile Modulus (GPa) ASTM D 638	2.9	5.53	-	-
Modulus at 5% (Mpa)	-	-	6.89	34.46
Elongation to Break % ASTM D 638	40	4.2	649	10
Hardness Shore D ASTM 2240	-	-	59	68
Flexural Strength (MPa)ASTMD790	108.3	150.3	9.3	43.0
Flexural Modulus	2771.8	4578.4	228.2	1322.4
IZOD (notched) (J/m) ASTM D 256	53.3	64.0 NB	NB	
Heat Deflection 0.46 MPa Temperature (°C) 1.82 MPa ASIM D 648	232	262	80	201
	61	243	46	173
Deformation under Load, % ASTM D 621	-	-	1.4	0.5

*All properties are Dry as Molded

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Product safety information is available upon request

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