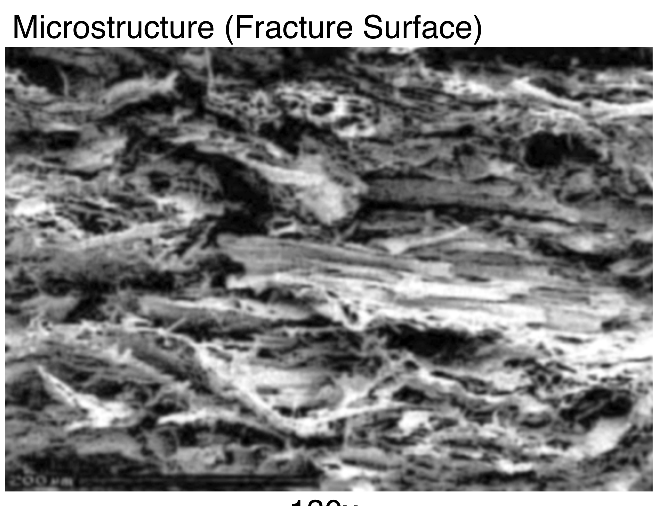
Comparative Mechanical Property Tests to International Standards (ISO) for 3 different types of Zeoform - all made from hemp.

Material Class: Other Materials (made from renewable raw materials)

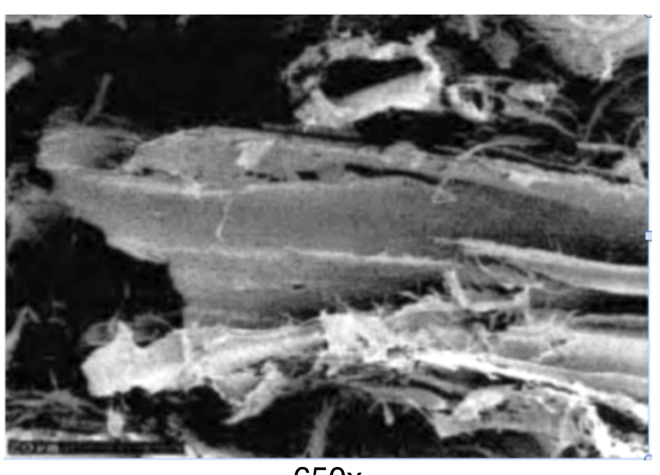
Zeoform LD

(Low Density) - made from
whole hemp plant - seeds removed

Microstructure (Fracture Surface)



130x

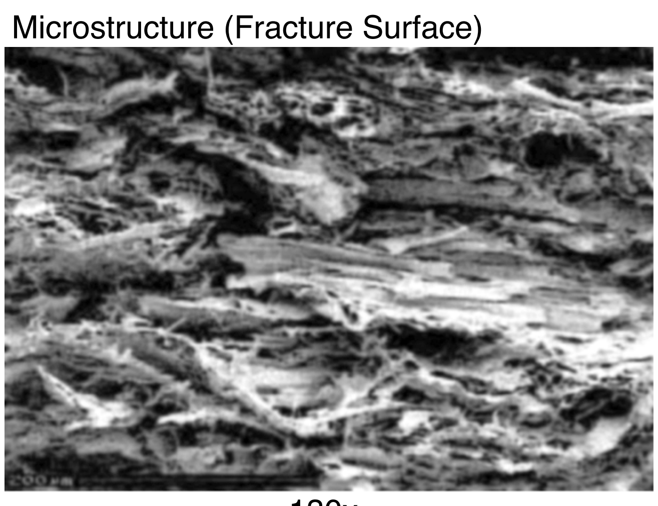


650x

Zeoform MD

(Medium Density) - made from
retted hemp fibres

Microstructure (Fracture Surface)



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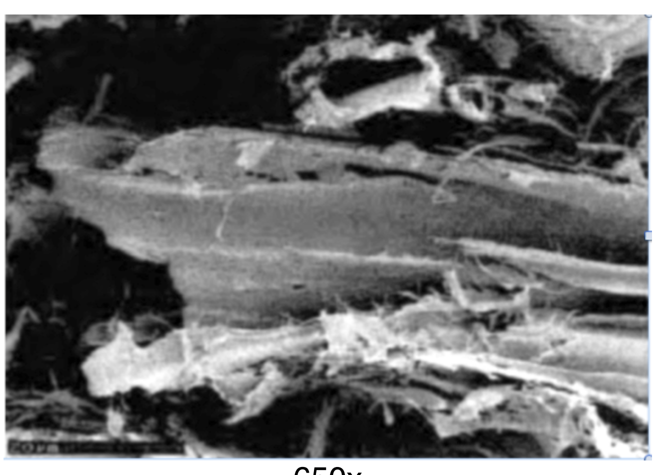
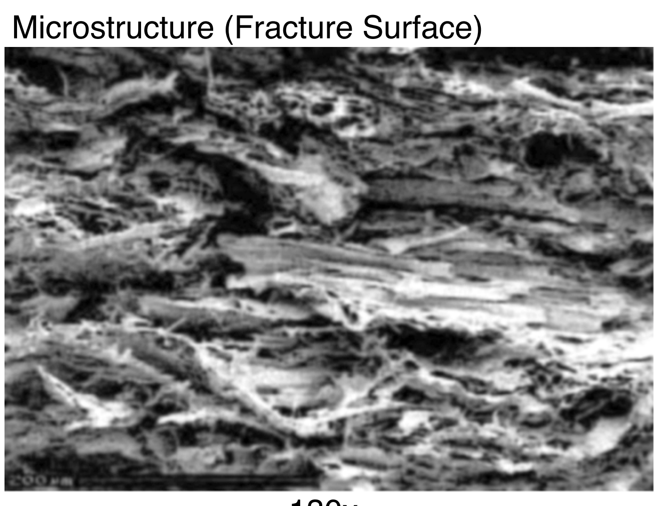


650x

Zeoform HD

(High Density) - made from
refined pure hemp cellulose

Microstructure (Fracture Surface)



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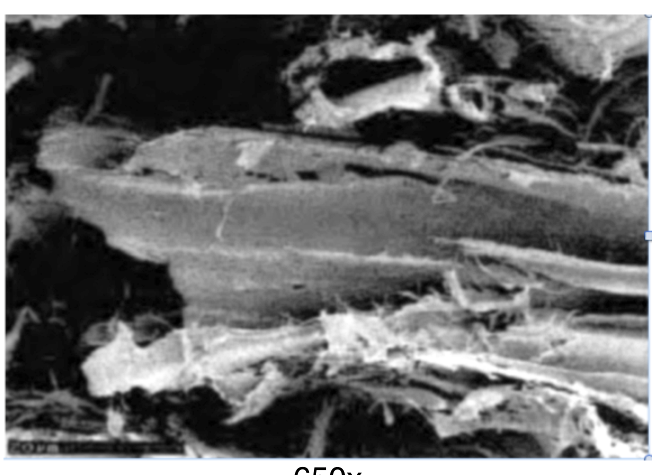

650x

Zeoform LD

Density [ISO 1183]

Density	P_{23}	[g/cm³]	0.574±0.043

Water Absorbtion (ISO 62)

Water absorbtion	C	[%]	127.3±1.4

At 23°C in water for 24 h after 24 h at 50°C Specimin Plates 50x50x4mm

Charpy-Impact Strength (ISO 179-1)

Charpy-Impact Strength			Temperature [°C] -20	23
Unnotched	a_{cU}	[kJ/m²]	1.5 ± 0.1	1.8 ± 0.1
Notched	a_{cN}	[kJ/m²]	0.8 ± 0.1	0.9 ± 0.0

Instrumented Punture Test (ISO 6603-2)

			Temperature [°C] -30	23
Maxiumum Force	F_M	[N]	983 ± 29	973 ± 35

Specimin 60mm dia x 4mm thick

Zeoform LD

Density [ISO 1183]

Density	P_{23}	[g/cm³]	1.126 ± 0.079

Water Absorbtion (ISO 62)

Water absorbtion	C	[%]	127.3±1.4

At 23°C in water for 24 h after 24 h at 50°C Specimin Plates 50x50x4mm

Charpy-Impact Strength (ISO 179-1)

Charpy-Impact Strength			Temperature [°C] -20	23
Unnotched	a_{cU}	[kJ/m²]	1.5 ± 0.1	1.8 ± 0.1
Notched	a_{cN}	[kJ/m²]	0.8 ± 0.1	0.9 ± 0.0

Instrumented Punture Test (ISO 6603-2)

			Temperature [°C] -30	23
Maxiumum Force	F_M	[N]	983 ± 29	973 ± 35

Specimin 60mm dia x 4mm thick

Zeoform LD

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Water Absorbtion (ISO 62)

Water absorbtion	C	[%]	127.3±1.4

At 23°C in water for 24 h after 24 h at 50°C Specimin Plates 50x50x4mm

Charpy-Impact Strength (ISO 179-1)

Charpy-Impact Strength			Temperature [°C] -20	23
Unnotched	a_{cU}	[kJ/m²]	1.5 ± 0.1	1.8 ± 0.1
Notched	a_{cN}	[kJ/m²]	0.8 ± 0.1	0.9 ± 0.0

Instrumented Punture Test (ISO 6603-2)

			Temperature [°C] -30	23
Maxiumum Force	F_M	[N]	983 ± 29	973 ± 35

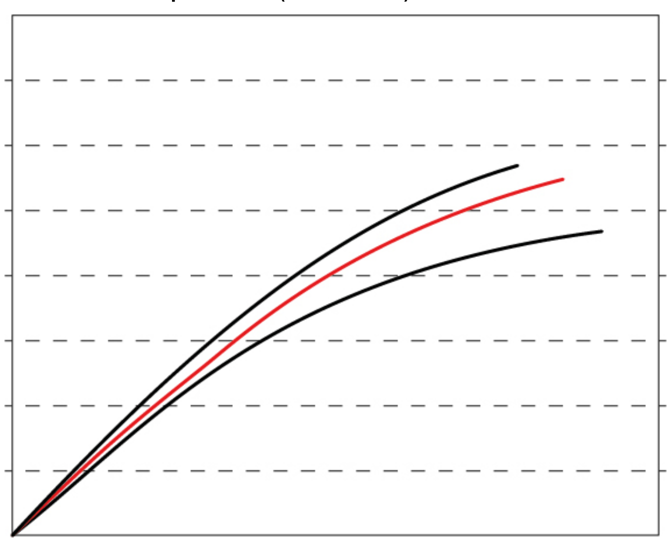
Specimin 60mm dia x 4mm thick

Tensile Properties (ISO 527)

			Temperature [°C] -20	0	23	60	100
Tensile Strength[1)]	E_1	[MPa]	1990 ±70	1870 ±70	1570 ±30		
Yeild Stress[2)]	σ_Y	[MPa]	-	-	-		
Elongation at Yeild[2)]	ε_Y	[%]	-	-	-		
Fracture Stress[2)]	σ_B	{MPa}	11.4 ±0.2	11.1 ± 0.4	8.9 ±0.3		
Elongation At Break[2)]	ε_B	[%]	0.78 ±0.08	0.95 ±0.2	0.89 ±0.07		
Tensile Strength[2)]	σ_M	{MPa}	11.4 ±0.2	11.1 ± 0.4	8.9 ±0.3		
Elongation at Tensile Strength[2)]	ε_M	[%]	0.78 ±0.08	0.95 ±0.2	0.89 ±0.07		

[1)]Test Speed 1mm/min [2)]Test Speed 5mm/min

Tensile Properties (ISO 527)



Tensile Properties (ISO 527)

			Temperature [°C] -20	0	23	60	100
Tensile Strength[1)]	E_1	[MPa]	1990 ±70	1870 ±70	1570 ±30		
Yeild Stress[2)]	σ_Y	[MPa]	-	-	-		
Elongation at Yeild[2)]	ε_Y	[%]	-	-	-		
Fracture Stress[2)]	σ_B	{MPa}	11.4 ±0.2	11.1 ± 0.4	8.9 ±0.3		
Elongation At Break[2)]	ε_B	[%]	0.78 ±0.08	0.95 ±0.2	0.89 ±0.07		
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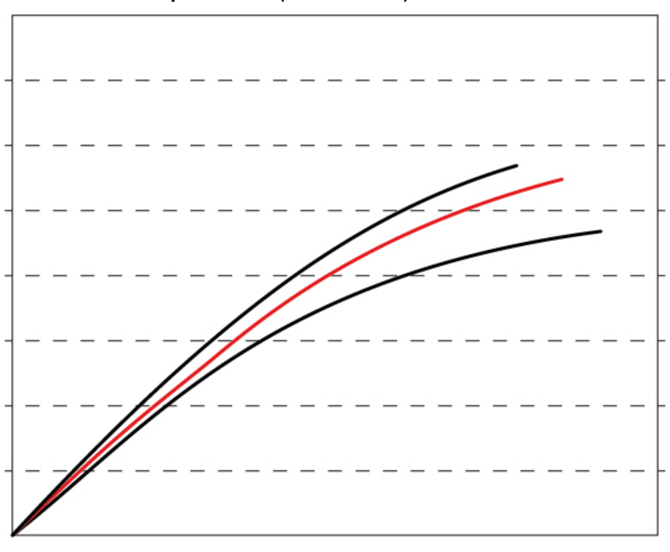
[1)]Test Speed 1mm/min [2)]Test Speed 5mm/min

Tensile Properties (ISO 527)



Tensile Properties (ISO 527)

			Temperature [°C] -20	0	23	60	100
Tensile Strength[1)]	E_1	[MPa]	1990 ±70	1870 ±70	1570 ±30		
Yeild Stress[2)]	σ_Y	[MPa]	-	-	-		
Elongation at Yeild[2)]	ε_Y	[%]	-	-	-		
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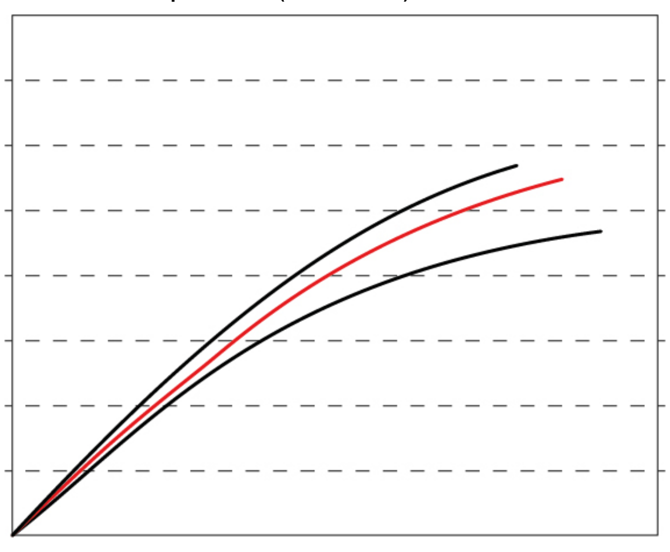
Tensile Properties (ISO 527)



Zeoform LD

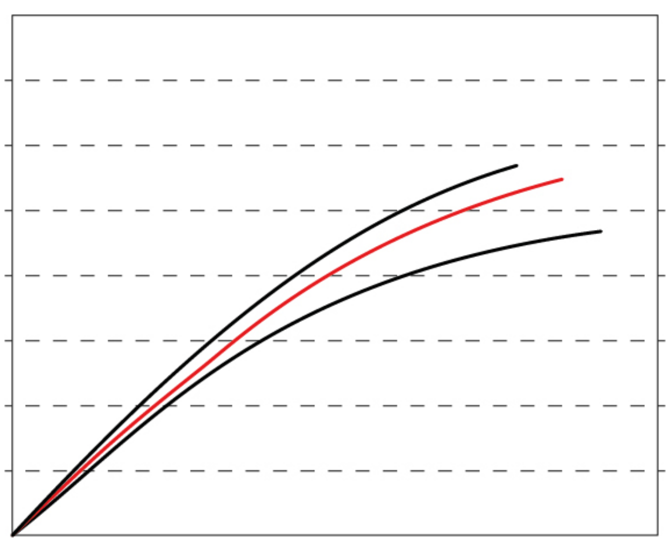
Flexural Properties (ISO 178)

Flexural Modulus	E_f	[MPa]	1810 ± 40
Flexural at Break	σ_{fB}	[MPa]	17.5 ± 0.5
Elongation at	ε_{fB}	[%]	1.4 ± 0.0
Flexural Strength	σ_{fM}	[MPa]	17.5 ± 0.5
Elongation at	ε_{fM}	[%]	1.4 ± 0.0

Creep Behaviour (ISO 899-1)

			Load [MPa] 5
Train-	$E_{t, 1h}$	[MPa]	1190
Creep-	$E_{t, 10h}$	[MPa]	1100
Modulus	$E_{t, 24h}$	[MPa]	993

Creep Strength (ISO 899-1)



Zeoform LD

Flexural Properties (ISO 178)

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Flexural at Break	σ_{fB}	[MPa]	17.5 ± 0.5
Elongation at	ε_{fB}	[%]	1.4 ± 0.0
Flexural Strength	σ_{fM}	[MPa]	17.5 ± 0.5
Elongation at	ε_{fM}	[%]	1.4 ± 0.0

Creep Behaviour (ISO 899-1)

			Load [MPa] 5
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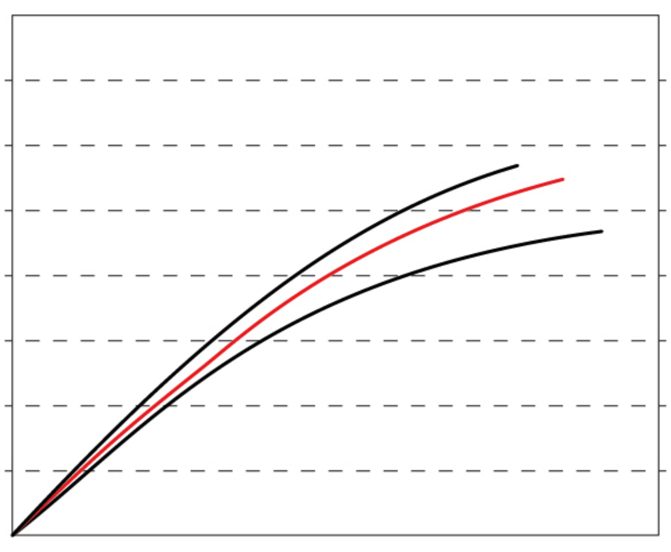
Creep-	$E_{t, 10h}$	[MPa]	1100
Modulus	$E_{t, 24h}$	[MPa]	993

Creep Strength (ISO 899-1)



Zeoform LD

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Flexural at Break	σ_{fB}	[MPa]	17.5 ± 0.5
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Flexural Strength	σ_{fM}	[MPa]	17.5 ± 0.5
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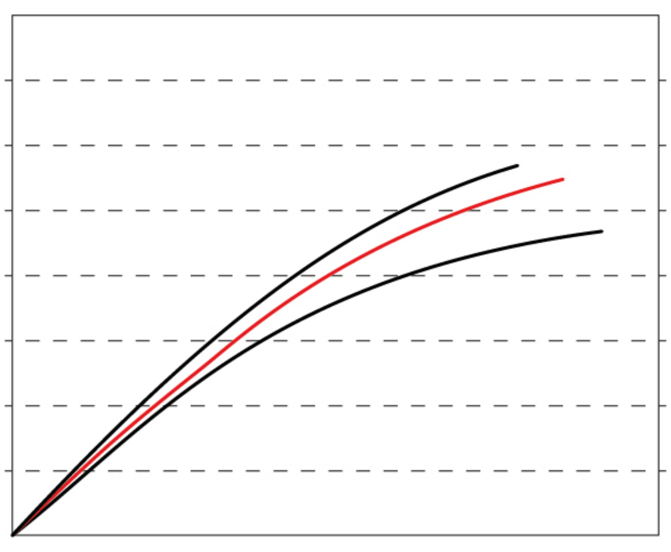
Creep Strength (ISO 899-1)

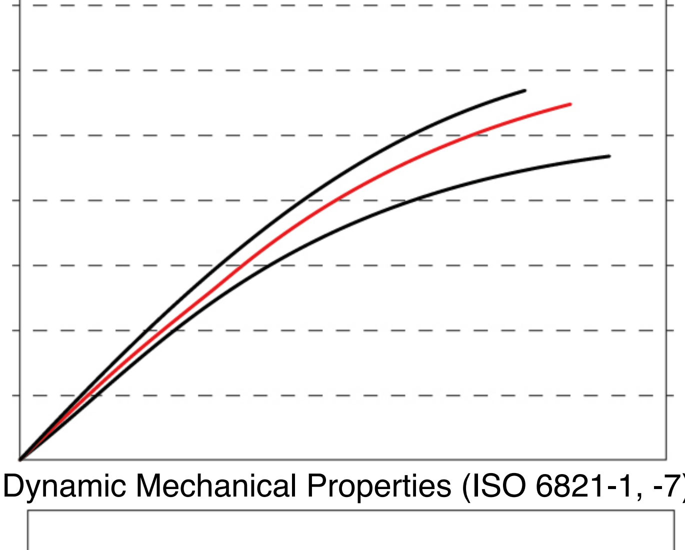


Zeoform LD

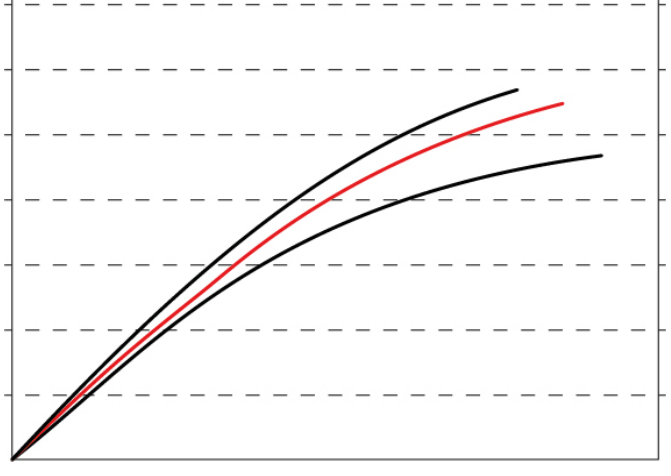
Heat Resistance (ISO 75, 306)

Heat Distortion Temperature	HDT Af	[°C]	107.1 ± 2.2
	HDT Cf	[°C]	62.7 ± 0.8
Vicat- Softening Temperature	VST B50	[°C]	Exposure too high

Dynamic Differential (ISO 11357)



Dynamic Mechanical Properties (ISO 6821-1, -7)

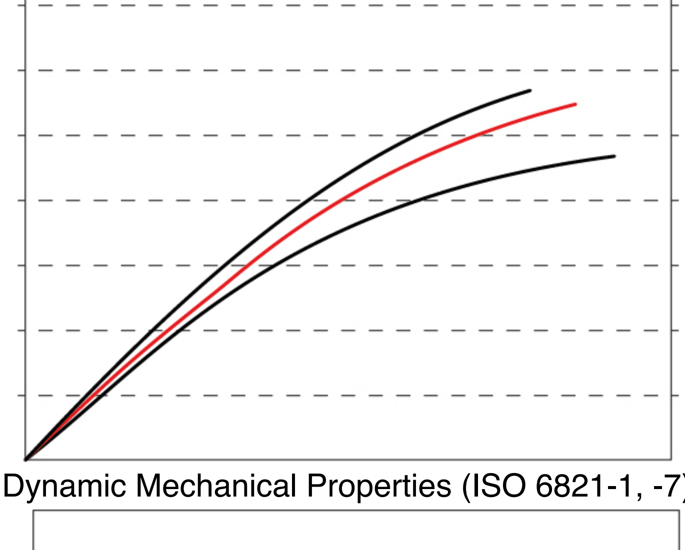


Zeoform LD

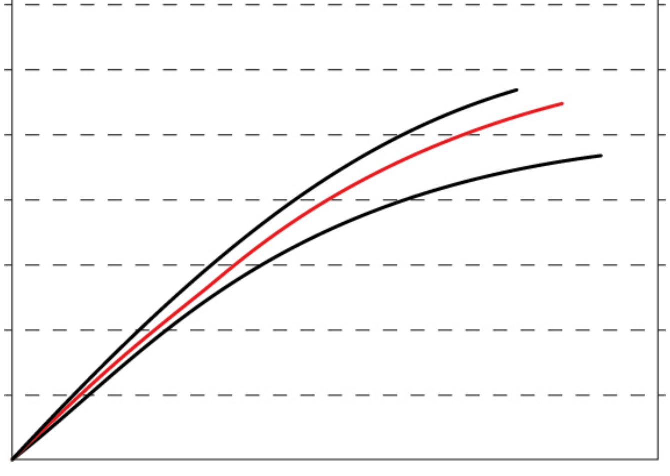
Heat Resistance (ISO 75, 306)

Heat Distortion Temperature	HDT Af	[°C]	107.1 ± 2.2
	HDT Cf	[°C]	62.7 ± 0.8
Vicat- Softening Temperature	VST B50	[°C]	Exposure too high

Dynamic Differential (ISO 11357)



Dynamic Mechanical Properties (ISO 6821-1, -7)



Zeoform LD

Heat Resistance (ISO 75, 306)

Heat Distortion Temperature	HDT Af	[°C]	107.1 ± 2.2
	HDT Cf	[°C]	62.7 ± 0.8
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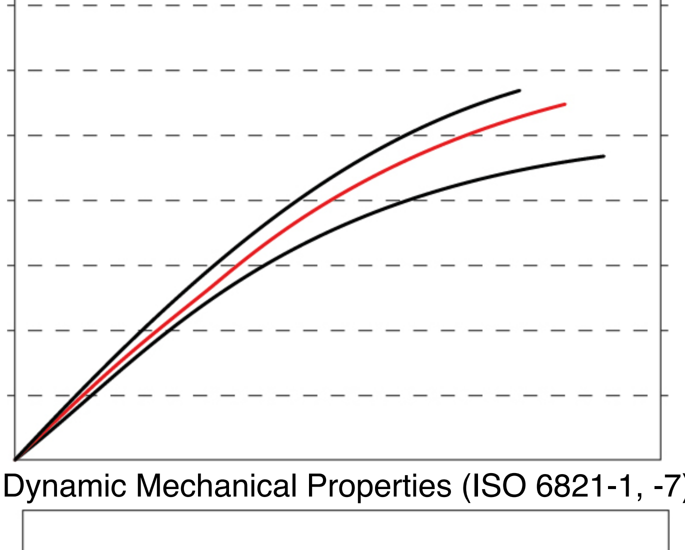

Dynamic Mechanical Properties (ISO 6821-1, -7)