TECHNICAL PROPERTIES OF ZELLAMID®

Property		Unit	Test method	Condition of specimen	ZELLAMID® 202 (PA6)	ZELLAMID® 202 MO (PA 6 +MoS2)	ZELLAMID® 202 XN (PA6 reinforced)	ZELLAMID® 250 250 SW (PA6.6)	ZELLAMID® 250 GF30 (PA6.6+30% Glassfibre)	ZELLAMID® 250 XPE (PA 6.6+PE)	ZELLAMID® 900 900SW (POM-C)	ZELLAMID® 900 XPE (POM-C + PE)	ZELLAMID® 900 XAS (POM-C antistatic)	ZELLAMID® 900 XU ELS (POM-C conductive)	ZELLAMID® 900 H 900 H SW (POM-H)
MECHANICAL PROPERTIES															
Tensile strength at break		MPa	ISO 527	dry	80	75	93	80	100	70	70	43	40	69	72
		MPa	ISO 527	moist	50			60	-		-				
Elongation at break		%	ISO 527	dry	50- 100	25	5	50	8		40		72	11	40
		%	ISO 527	moist	200			150	-		-				
Modulus of elasticity in tension		MPa	ISO 527	dry	3000	2700	4200	3200	4800	2700	3000	2200	1380	3600	3000
		MPa	ISO 527	moist	1500			1600	-		-				
Charpy Impact strength	+ 23°C	kJ/m²	ISO 179/1eU	dry	no break	no break		no break	20	40	no break	50	no break	80	no break
	- 40°C	kJ/m²	ISO 179/1eU	dry	no break			no break	-		80				
Charpy Impact strength (notched)		kJ/m²	ISO 179/1eA	dry	70			80	-	5	-	5		3,4	10
		kJ/m²		moist	-			-	-		-				
Hardness Shore, scale D			ISO 868	dry	75	80	80	80	85	78	81	77	74	80	84
Time yield limit $\sigma_{1/1000}$	23°C/50% RH	MPa	ISO 899	moist	5.5			6.0	-		14				
	100°C	MPa	ISO 899	dry	2.5			3.5	-		-				
Apparent modulus $E_{c/1000\ 2O}$	23°C/50% RH	MPa	ISO 899	moist	230			400	-		-				
THERMAL PROPERTIES															
Heat distortion temperature	Method A	°C	ISO 75	dry	55 – 75		168	100	250	120	110	120			
	Method B	°C	ISO 75	dry	> 160			> 200	250		160				
Melting point	Method A	°C	ISO 3146	-	220	220	215	255	255		164-168		165	175	178
Maximum service temperature for few hours operation		°C	- -	-	≤ 180			≤ 200	200		-				
TEP 5 000 hours (50% of tensile strength) [1]		°C	IEC 216	-	90			95	-		-				
TEP 20 000 hours (50% of tensile strength) [1]		°C	IEC 216	-	75		140	80	-		100				
Thermal coefficient of linear expansion		$1/K.10^{-5}$	DIN 53752	dry	7– 10			7– 10	2 - 3	8,5	11	14			10
Thermal conductivity	Method A	W/(K.m)		dry	0.23			0.23	0.27		-				
Specific heat		J/(g.K)	IEC 1006	dry	1.7			1.7	1.5		1.5				
DIELECTRIC PROPERTIES															
Dielectric constant	1 MHz	-	IEC 250	dry	3.5			3.2	-	3,3	3.8	4,4			
		-	IEC 250	moist	7.0			5.0	-		-				
Dissipation factor tan δ	1 MHz	-	IEC 250	dry	0.023			0.026	-		0.024	0,003			
		-	IEC 250	moist	0.3			0.2	-		-				
Dielectric strength		KV/mm	IEC 243	dry	100			120	30		> 20		14		
		KV/mm	IEC 243	moist	60			80	-		-				
Volume resistivity		Ω.cm	IEC 93	dry	10^{15}	$> 10^{12}$	$> 10^{12}$	10^{15}	$> 10^{12}$	10^{15}	10^{15}	10^{14}	10^{9}	10^{4}	$>10^{12}$
		Ω.cm	IEC 93	moist	10^{12}			10^{12}	-		-				
Surface resistivity		Ω	IEC 93	dry	10^{13}	$> 10^{12}$	10^{11}	10^{13}	10^{11}	10^{13}	-	10^{14}	10^{10}	10^{4}	$>10^{12}$
		Ω	IEC 93	moist	10^{10}			10^{10}	-		-				
Resistance to tracking	KA/ KB method	-	IEC 112	dry/moist	KB > 600			KB >600	-		KB >600				
	KC method	-	IEC 112	dry/moist	KC > 600			KC > 600	-		-				
MISCELLANEOUS PROPERTIES															
Mass density	Method D, E	g/cm³	ISO 1183	dry	1.13– 1.15	1,15	1,15	1,15	1.35	1,12	1.41-1.43	1,34	1,35	1,41	1,42-1,43
Moisture absorption at 23°C, 50% RH	Saturation	%	ISO 1110	-	3.0±0.4	3		2.8±0.3	1.5	2,2	0.20	0,2			0,2
Water absorption at 23 °C	Saturation	%	ISO 62	-	8.0±0.5	8		8.5±0.5	5.5	8,5	0.25	0,8			
Fire performance	Flameability Acc. VDE		VDE 0304	dry	II b			II b	-		BH3-25mm/min				
	Flameability of interior materials in passanger cars h>1mm	mm/min	FMVSS 302	moist	< 100			< 100	-		-				
	Flameability according UL Standard (thickness of specimen 1,6 mm)	-	UL 94	-	HB	HB		HB	HB	HB	HB	HB			HB
Resistance to wear [2]		µm/km	ISO 7148-2	dry	-			-	-		-				

● Dry= dried at 80°C and 1 mbar until weight is constant (moisture content less than 0.2%) ● Moist=after storage in a standard atmosphere of 23° C and 50% relative humidity (DIN 50014) until saturation.
● [1] Data of the resin only ● [2] Made by a pin / rotating disc test according DIN-ISO 7148-2 under following conditions: R_a = 0,35 – 0,45 µm (steel disc), v = 0,3 m/s, p = 3 N/mm², time T>16h ● All information are without warranty and liability. ● See page 49 - Legal Notes

TECHNICAL PROPERTIES OF ZELLAMID®

Property		Unit	Test method	Condition of specimen	ZELLAMID® 1400 1400SW (PET-C)	ZELLAMID® 1400 H (PET-H)	ZELLAMID® 1400 T (PET-C+solid lubricant)	ZELLAMID® 1400 XPBT (PBT)	ZELLAMID® 1500 (PEEK)	ZELLAMID® 1500 T (PEEK mod.)	ZELLAMID® 1500 GF30 (PEEK + 30% GF)	ZELLAMID® 1000 (PEI)	ZELLAMID® 1000 GF20CRF (PEI + 20% GF)	ZELLAMID® 1900 (PPS)	ZELLAMID® 1900 GF40 (PPS + 40% GF)	ZELLAMID® 2100 (PPSU)	ZELLAMID® 2200 (PI)
MECHANICAL PROPERTIES																	
Tensile strength at break		MPa	ISO 527	dry	80	50	75	56	97	141	155	105	135	33	185	70	110
		MPa	ISO 527	moist	-		-		-	-							
Elongation at break		%	ISO 527	dry	20	14	5	>50	25	2	2	60			1,9	>60	20
		%	ISO 527	moist	-		-		-	-							
Modulus of elasticity in tension		MPa	ISO 527	dry	3200	3600	2230	2600	3600	9000	11000	3200	6000	4200	14000	2300	3800
		MPa	ISO 527	moist	-		-		-	-							
Charpy Impact strength	+ 23°C	kJ/m²	ISO 179/1eU	dry	82		23	no break	no break	-	11,3	no break		no break	45	no break	no break
	- 40°C	kJ/m²	ISO 179/1eU	dry	-		-		-	-							
Charpy Impact strength (notched)		kJ/m²	ISO 179/1eA	dry	14		10	6	-	-	8,9					-	-
		kJ/m²		moist	-		-		-	-							
Hardness Shore, scale D			ISO 868	dry	81	80	81	80	88	85	-	82	87				
Time yield limit $\sigma_{1/1000}$	23°C/50% RH	MPa	ISO 899	moist	12		-		-	-							
	100°C	MPa	ISO 899	dry	-		-		-	-							
Apparent modulus $E_{C/1000\ 2O}$	23°C/50% RH	MPa	ISO 899	moist	-		-		-	-							
THERMAL PROPERTIES																	
Heat distortion temperature	Method A	°C	ISO 75	dry	67		-	50	152	293	315			95	200	-	-
	Method B	°C	ISO 75	dry	165		-	135	-	-				115	270	207	240
Melting point	Method A	°C	ISO 3146	-	255	255	-	235	340	340	340			280	280	-	400
Maximum service temperature for few hours operation		°C	- -	-	160		160		300	300							
TEP 5 000 hours (50% of tensile strength) [1]		°C	IEC 216	-	115		115		260	260							
TEP 20 000 hours (50% of tensile strength) [1]		°C	IEC 216	-	100		100		-	-							
Thermal coefficient of linear expansion		$1/K.10^{-5}$	DIN 53752	dry	6	6	6	9-15	4.7	2.2	1,7	5		5,5	3	5,6	
Thermal conductivity	Method A	W/(K.m)		dry	-		-		0.25	0.24							
Specific heat		J/(g.K)	IEC 1006	dry	-		-		-	-							
DIELECTRIC PROPERTIES																	
Dielectric constant	1 MHz	-	IEC 250	dry	3.3		-	3,2	-	-							
	-	-	IEC 250	moist	-		-		-	-							
Dissipation factor tan δ	1 MHz	-	IEC 250	dry	0.02		-		0.004	-							
	-	-	IEC 250	moist	-		-		-	-							
Dielectric strength		KV/mm	IEC 243	dry	50		-		20	-							
		KV/mm	IEC 243	moist	-		-		-	-							
Volume resistivity		Ω.cm	IEC 93	dry	10^{16}	$>10^{12}$	-	$5x10^{13}$	10^{16}	-		$>10^{13}$	$>10^{12}$	$>10^{12}$	$>10^{12}$	$>10^{13}$	$>10^{13}$
		Ω.cm	IEC 93	moist	-		-		-	-							
Surface resistivity		Ω	IEC 93	dry	-	$>10^{12}$	-	$>10^{12}$	-	-		$>10^{13}$	$>10^{12}$	$>10^{12}$	$>10^{12}$	$>10^{15}$	$>10^{13}$
		Ω	IEC 93	moist	-		-		-	-							
Resistance to tracking	KA/ KB method	-	IEC 112	dry/moist	KA >450		-		-	-							
	KC method	-	IEC 112	dry/moist	KC > 600		-		-	-							
MISCELLANEOUS PROPERTIES																	
Mass density	Method D, E	g/cm³	ISO 1183	dry	1.36	1,36	1.38	1,3	1.32	1.48	1,51	1,27	1,42	1,35	1,64	1,29	1,37
Moisture absorption at 23°C, 50% RH	Saturation	%	ISO 1110	-	~ 0.23	0,3	~ 0.23		0.1	0,06	0,11	0,7				0,37	0,24
Water absorption at 23 °C	Saturation	%	ISO 62	-	~ 0.5	0,5	~ 0.5	0,5	0.5	-		1,25		0,02	0,02	1,1	0,72
Fire performance	Flameability Acc. VDE		VDE 0304	dry	II b		-		-	-							
	Flameability of interior materials in passanger cars h>1mm	mm/min	FMVSS 302	moist	< 100		-		-	-							
	Flameability according UL Standard (thickness of specimen 1,6 mm)	-	UL 94	-	HB	HB	HB	HB	V0	V0	V0	V0	V0	V0	V0	V0	V0
Resistance to wear [2]		µm/km	ISO 7148-2	dry	22		1.1		-	-							

● Dry= dried at 80°C and 1 mbar until weight is constant (moisture content less than 0.2%) ● Moist=after storage in a standard atmosphere of 23° C and 50% relative humidity (DIN 50014) until saturation.
● [1] Data of the resin only ● [2] Made by a pin / rotating disc test according DIN-ISO 7148-2 under following conditions: R_a = 0,35 – 0,45 µm (steel disc), v = 0,3 m/s, p = 3 N/mm², time T>16h ● All information are without warranty and liability. ● See page 49 - Legal Notes