

Bakelite®  
Engineering Thermosets

High-Performance  
Molding Compounds



## Explanations

- 1) Elongation 0.05 % – 0.25 %
- 2) Following IEC 60093, 60250
- 3) Short term, electrode layout Pø 25 mm / Pø 25 mm in transformer oil equivalent to IEC 60296.
- 4) UL 94 colour designation:

ALL = all colours, BG = beige, BK = black, BN = brown, BL = blue,  
GN = green, GY = grey, NC = natural, OR = orange, RD = red,  
WT = white, YL = yellow.

- 5) Following ISO 62

\* Properties marked with a star are elements of the CAMPUS® database and are based on the obliging introduced guide lines of the norm comitee of plastics.

## Erklärungen

- 1) Dehnung 0.05 % – 0.25 %
- 2) In Anlehnung an IEC 60093, 60250
- 3) Kurzzeit-Test, Elektrodenanordnung Pø 25 mm / Pø 25 mm im Transformatoröl entsprechen IEC 60296.
- 4) UL 94-Farbkennzeichnungen:

ALL = alle Farben, BG = beige, BK = schwarz, BN = braun, BL = blau,  
GN = grün, GY = grau, NC = natur, OR = orange, RD = rot, WT = weiss,  
YL = gelb.

- 5) In Anlehnung an ISO 62

\* Die mit Sternchen gekennzeichneten Eigenschaften sind Bestandteile der Kunststoff-Datenbank CAMPUS® und basieren auf den vom Fachnormenausschuss Kunststoffe verbindlich eingeführte Richtlinien.

Property Eigenschaften	Unit Einheit	Bakelite® EP 8412	Bakelite® PF 1110	Bakelite® PF 2874	Bakelite® PF 6501	Bakelite® PF 6510	Bakelite® PF 6680	Bakelite® PF 6771	Bakelite® PF 7595	Norm Standard ISO* / IEC** ASTM / UL	Norm Standard DIN EN ISO* DIN** / DIN IEC VDE / DIN ISO
Short term Kurzbezeichnung	-	EP GF40 MD30	PF GF40 MD40	PF GF15 MD20	PF GF35 MD10	PF GF30 GB25	PF GF30 GB20	PF GF50 X	PF Z15 X	-	-
Density* (23 °C) Dichte* (23 °C)	g / cm³	1.85	2.06	1.57	1.6	1.7	1.7	1.7	1.58	1183*	53479**
Molding shrinkage* (injection molding, longitudinal) Verarbeitungsschwindung* (Spritzgießen, längs)	%	-	0.15	0.5	0.2	0.15	0.25	0.20	0.20	2577*	53464**
Post shrinkage* (injection molding, 168 h / 110 °C) Nachschwindung* (Spritzgießen, 168 h / 110 °C)	%	0.5	0.03	0.25	0.1	0.05	0.05	0.05	0.1	2577*	53464**
Molding shrinkage* (compression molding, longitudinal) Verarbeitungsschwindung* (Pressen, längs)	%	0.2	-	0.2	0.2	-	-	-	0.05	2577*	53464**
Post shrinkage* (compression molding, 168 h / 110 °C) Nachschwindung* (Pressen, 168 h / 110 °C)	%	0	-	0.15	0.1	-	-	-	0.1	2577*	53464**
Tensile strength* (5 mm / min) Zugfestigkeit* (5 mm / min)	MPa	55	150	65	85	100	115	115	45	527-1/2*	527-1/2*
Tensile modulus of elasticity* (1 mm / min) <sup>1)</sup> Zug-E-Modul* (1 mm / min) <sup>1)</sup>	MPa	13000	29500	10500	15000	16500	20000	17000	12000	527-1/2*	527-1/2*
Compression strength (test spec. flat tested) Druckfestigkeit (Probekörper flach geprüft)	MPa	170	325	225	285	260	275	265	130	604*	604*
Flexural strength (2mm / min) Biegefestigkeit (2 mm / min)	MPa	120	260	125	180	200	180	215	80	178*	178*
Flexural modulus of elasticity Biege-E-Modul	MPa	15000	27000	10500	12500	15500	13500	16000	12000	178*	178*
Charpy impact strength* (23 °C) Charpy-Schlagzähigkeit* (23 °C)	kJ / m²	8.5	15.5	9	12	15	15	17.5	3.5	179-1/2 eU*	179-1/2 eU*
Charpy notched impact strength* (23 °C) Charpy-Kerbschlagzähigkeit* (23 °C)	kJ / m²	3.8	4.5	2	3.5	4.0	3.5	4.5	-	179-1/2 eA*	179-1/2 eU*
Ball indentation hardness (H 961/30) Kugeldruckhärte (H 961/30)	MPa	400	-	350	400	-	450	275	450	2039/P1*	2039/T1*
Temperature of defl. under load HDT-C* (8.00 MPa) Formbeständigkeitstemperatur HDT-C* (8.00 MPa)	°C	120	190	150	170	175	170	170	175	75-2*	75-2*
Surface resistivity* <sup>2)</sup> Spezifischer Oberflächenwiderstand* <sup>2)</sup>	Ω	1E + 12	1E + 11	1E + 11	1E + 10	1E + 11	1E + 11	1E + 11	-	60093**	DIN IEC 93
Volume resistivity* <sup>2)</sup> Spezifischer Durchgangswiderstand* <sup>2)</sup>	Ω x cm	1E + 13	1E + 12	1E + 11	1E + 11	1E + 12	1E + 12	1E + 12	-	60093**	DIN IEC 93
Electric strength* (1 mm thickness) <sup>3)</sup> Elektrische Durchschlagfestigkeit* (1 mm Wandstärke) <sup>3)</sup>	kV / mm	30	27	26	30	25	-	30	-	60243-P1**	DIN IEC 243-T3
Proof tracking index* (Test liquid A) Prüfzahl der Kriechwegbildung* (Prüflüssigkeit A)	PTI	250	225	175	-	-	-	-	-	60112**	DIN IEC 112
Flammability UL 94* (tested thickness) <sup>4)</sup> Entflammbarkeit UL 94* (geprüfte Probekörperdicke) <sup>4)</sup>	Step / mm Stufe / mm	94 HB / 1.5 (BK)	94 V0 / 0.8	94 V0 / 0.75 (BK)	-	-	-	-	-	UL 94	VDE 0304-T3
Water absorption (24 h / 23 °C) <sup>5)</sup> Wasseraufnahme (24 h / 23 °C) <sup>5)</sup>	mg	10	5	25	13	10	10	12	6	62*	53495 Verf. 3**
Water absorption (24 h / 23 °C) <sup>5)</sup> Wasseraufnahme (24 h / 23 °C) <sup>5)</sup>	%	0.15	0.1	0.55	0.25	0.20	0.1	0.25	0.15	62*	53495 Verf. 3**

## Bonding

### Applications

- Dimensionally accurate, high precision housings
- High-strength components and housings
- Fuel transporting applications

### Material Description

Phenol molding compound, 80% inorganic (silica-free) extender

### Special Advantages

- Special developed thermosetting molding compound provides an outstanding combination of processing and physical properties
- Free flowing
- Processable with commercial injection or compression machines
- Free of quartz powder – low abrasion and high EHS-Standard
- Highest Modulus of Elasticity
- Highest Flexural and Tensile Strength
- Highest dimension stability
- Isotropic behaviour
- Lowest CTE (coefficient of thermal elongation) close to steel
- Physical properties mostly stable in a wide temperature range (-30 - +200 °C)

- No need of post curing for service temperatures < 180 °C

### Best in Class

### Anwendungen

- maßgenaue, hochpräzise Gehäuse
- Hochfeste Bauteile und Gehäuse
- Benzinführende Anwendungen

### Material-Eigenschaften

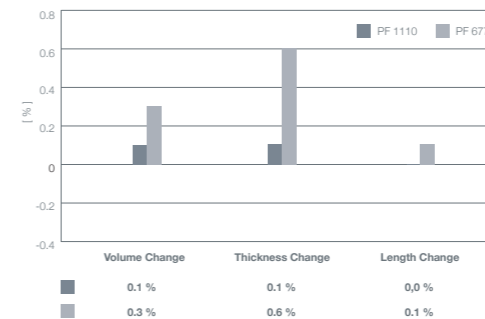
Phenol-Formmasse, 80% anorganisch gefüllt, quarzfrei

### Zusätzliche Vorteile

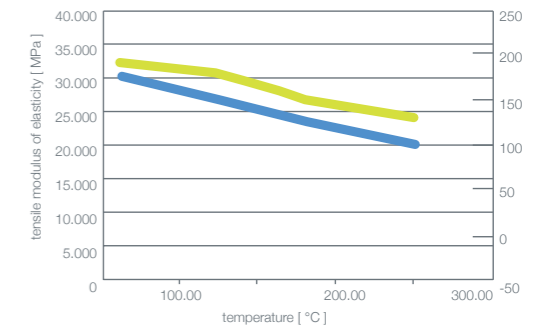
- Hochaktuelle duroplastische
- Formmasse, die eine herausragende Kombination aus thermomechanischen und verarbeitungstechnischen Eigenschaften aufweist
- Rieselfähig
- Verarbeitbar auf handelsüblichen Spritzgießmaschinen oder Preßautomaten
- Quarzmehlfrei – geringer Werkzeug- und Maschinenverschleiß / hoher EHS-Standard
- Höchste Steifigkeit (Elastizitätsmodul)
- Höchste Biege- und Zugfestigkeit
- Höchste Dimensionsstabilität

- Isotropische Eigenschaften (orientierungsunabhängig)
- Niedrigster CTE (thermischer Längenausdehnungskoeffizient) im Bereich von Stahl
- Physikalische Eigenschaften weitgehend konstant in einem weiten Temperaturbereich (-30 bis +200 °C)
- Keine Notwendigkeit des Temperns bei Anwendungstemperaturen bis 180 °C
- Überragend in allen Eigenschaften

### Storage in Test Fuel FAM-B, 250 h at 80 °C



### Bakelite® Molding Compound PF 1110 thermomechanical performance



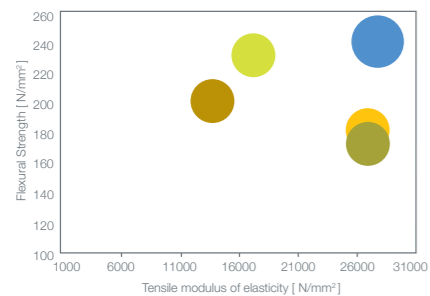
Temperature	tensile strength [MPa]	tensile modulus of elasticity [MPa]	elongation at break [%]
-40	178	32106	0.631
23	152	30419	0.623
80	128	26856	0.655
150	101	23828	0.651

## Bakelite® PF 1110

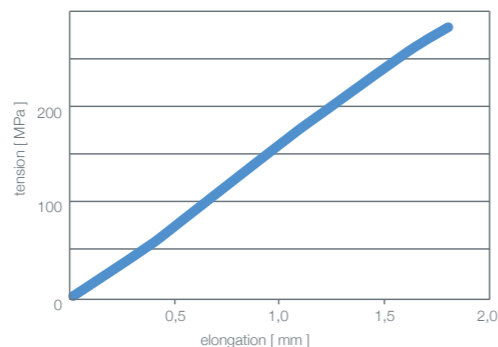
Thermoset Molding Compounds for the Highest Demands

Duroplastische Formmassen für höchste Ansprüche

### Mechanical Performance Hexion vs. Most Advanced Competition MCs

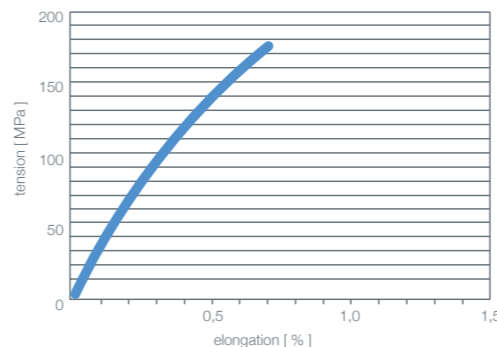


### Bakelite® Molding Compound PF 1110 Flexural Strength



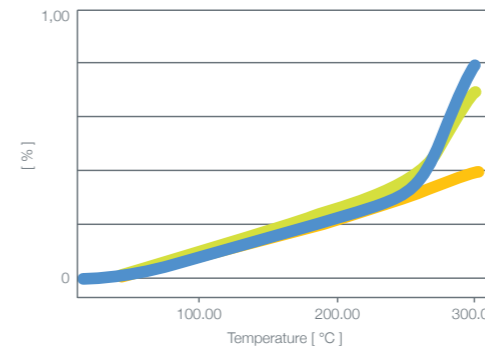
Property	Value
EMod [MPa]	29148
Rm [MPa]	167.0
s-F max [%]	0.68
s	663
v	2.28

### Bakelite® Molding Compound PF 1110 Tensile Strength



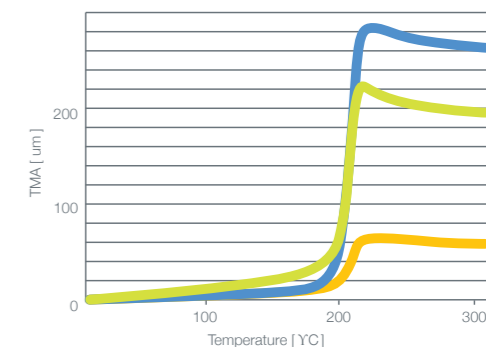
Property	Value
EMod [MPa]	26208
Fmax [MPa]	275.4
e-break [%]	1.033
s	844
v	3.22

### TMA (Thermal Mechanical Analysis) PF 1110 CTE 3D, post cured



Temperature [°C]	CTE [10 <sup>-4</sup> /K]	Material	α at 20 °C [10 <sup>-4</sup> /K]
60.00	9.63	Aluminum	23
100.00	13.84	Concret	10
160.00	15.33	Diamond	1.3
200.00	15.81	Iron	12.2
60.00	9.63	Glass (plain glass)	7.6
100.00	13.84	Gold	14.2
160.00	15.33	Gray cast iron	9
200.00	15.81	Copper	16.5
60.00	10.75	Molybdenum	5.2
100.00	12.88	Nickel	13
160.00	14.03	Steel	13
200.00	14.39	bibliographical reference	

### TMA (Thermal Mechanical Analysis) PF 1110 CTE 3D, not post cured



Temperature [°C]	CTE [10 <sup>-4</sup> /K]
28.50	14.42
50.00	15.15
100.00	19.42
27.86	14.71
50.00	17.72
100.00	18.57
30.23	8.99
50.00	10.83
100.00	11.26

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