



5MG.001 Composite Materials

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YZZ and ZYC Zirconium Oxide Fibre, up to 1.700 °C

SIZAL®, up to 1,800 °C

ZYBF and FBD Zirconium Oxide Fibre, up to 2,200 °C

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Final Advanced Materials formulates, processes, and manufactures a wide range of composite materials with high heat capacity. The proposed solutions are based on quality materials, machinable with conventional tools, available in all general mechanical workshops. Our team accompanies you from the selection of the material to the assembly of the finished product.

Technical composites originate from two sources:

- Composites based upon organic resins
- Mineral composites

Technical composites permit the engineering of refractory products for targeted applications:

Thermally-insulating mechanical components

- Glass-making industry, smelting works, mechanical construction,
- Aluminium industry, steel making,
- Construction of furnaces, nuclear industry, etc.

Thermal insulation panels

- Particle board presses,
- Vulcanizing presses,
- Plywood presses, stamping presses,
- Moulding presses, injection-moulding presses,
- Injection-moulding tools, etc.

Furnace claddings and components

- Electric furnaces, induction furnaces, arc furnaces, crucible furnaces, etc.

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Applications

Organic resin-based composites permit the production of components which remain dimensionally stable at temperatures up to 500 °C. Mineral composites (with inorganic bonds) provide options for a wide range of applications at higher temperatures, from 500 up to 2,000 °C.

There are numerous fields of application for these materials: they are extensively employed in the electrical, chemical, nuclear, glass-making and aluminium industries, in mechanical construction, furnace construction and steel making.

Thermally-insulating mechanical components

Standard panels provide the option for the off-plan machining of complex components. The choice of composite material is dependent upon the thermal and mechanical loads involved. These constraints will dictate the type of composite, its thermal insulation capabilities and mechanical resistance, in the interests of perfect adaptation to its final application.

Final Advanced Materials machines various types of products: one-off components, prototypes and series production components.

Examples of mechanical components produced from refractory composites:

- Static electrical insulators in electric power installations
- Electrical insulators in induction systems
- Construction of electric furnaces, induction furnaces and arc furnaces
- Flat gaskets and sealing components
- High-frequency welding technology
- Insulation of press plates
- High-voltage switchgear
- Heating elements

Thermal insulation panels

Thermal insulation panels produced from technical composites provide the ideal physical and chemical compromise for thermal insulation.

Thermal insulation panels act as insulating barriers for the effective protection of sensitive components, particularly hydraulic, electrical and electronic circuits. This type of product is very closely tailored to the requirements of manufacturers of injection-moulding presses.

Thermal insulation panels also permit the even distribution of heat and the effective control of thermal masses. They thus permit the achievement of substantial energy savings and the execution of rational production.

The product qualities of E-6000, E-60 and MC-5000HT have been developed, not only to ensure high-temperature resistance but also to deliver excellent mechanical strength and exceptional ease of machining.

**Examples of applications of thermal insulation panels:**

- Vulcanizing presses, plywood presses, stamping presses, injection-moulding presses, moulding presses, etc.

Furnace claddings and components

Mineral-based technical composites provide an effective solution for the insulation of industrial furnaces, where they are incorporated in a mechanical assembly. They are advocated by health and safety standards for refractory fibre-based flexible insulating materials.

Technical composite panels are available in large dimensions and are simple to deploy, using techniques which are closely akin to traditional joinery. After installation, their properties remain consistent, even in response to substantial thermal loading, and with no release of harmful dusts.

Examples of applications of furnace components:

- Electric furnaces, induction furnaces, arc furnaces, crucible furnaces, etc.

Benefits

- Thermal resistance
- Excellent dimensional stability
- Suitability for sealing applications
- Exceptional toughness
- Excellent resistance to radiation
- Good mechanical resistance
- High dielectric strength
- Substantial wear resistance
- High compressive strength
- Limited release of gases



Products

Final Advanced Materials works with various types of technical composites. Materials may have organic or mineral bonds, depending upon their application. Mineral technical composites are resistant to higher temperatures than organic technical composites.

Organic Technical Composites, up to 500 °C

Our range of technical composites based on fibreglass and epoxy resin allows us to offer you a complete selection of solutions up to a maximum temperature of 350 °C. These technical composites offer full thermal and electrical insulation. In addition to controlled flammability, they offer arc protection and can be used wherever temperature resistance, dimensional stability and mechanical resistance are essential parameters. Furthermore, we have endeavoured to make not only strong materials, but also excellent workability in order to guarantee easy mechanical work with conventional tools.

Epoxy Resins, up to 350 °C

Epoxy, or polyepoxide, is a resin produced by the polymerization of epoxide monomers using a hardener. Hardening is achieved by the action of heat. This material is frequently employed in the form of a composite adhesive or paint.

Available Products

E-6000: This product combines low thermal conductivity ($0.25 \text{ W.m}^{-1} \cdot \text{K}^{-1}$) with low density, thus permitting the production of more delicate and lightweight insulating components. It is resistant to a continuous temperature of 220 °C and a peak temperature of 320 °C. This material is laminated from a basis of glass-fibre matting and whitish-yellow epoxy resin. It shows good resistance to chemical agents.

E-60: This product delivers a superior mechanical and thermal performance to E-6000 but is less effective as a thermal insulator. It is resistant to a continuous temperature of 260 °C and a peak temperature of 330 °C. It is laminated from a basis of grey-coloured glass roving and epoxy resin.

**Composite Materials****Available Products**

Product	Item N°	Type	Dimensions	Thickness	Tolerances
E6000	080-0016	Board	1,900 x 1,000 mm 2,440 x 1,200 mm	4 to 140 mm	Thickness ±0.1 mm
E60	080-0017	Board	2,140 x 1,040 mm 2,800 x 1,200 mm	3 to 80 mm	Thickness ±0.2 mm Linear 0 /+30 mm Parallel: 0.3 mm/ml on corrected board

Customed designs are available on request

Technical Data

Property		Unit	E6000	E60
Item N°			080-0016	080-0017
Composition			Fiberglass matting Epoxy resin	Fiberglass roving Epoxy resin
Colour			yellow beige	grey-brown
Density DIN 53479		kg/cm ³	1,850	1,980
Thermal Properties				
Max. Operating Temperature		°C	220	260
Max. Peak Temperature		°C	250	330
Thermal Conductivity DIN 52612		W.m ⁻¹ .K ⁻¹	0.35	0.30
Mechanical Properties				
Compressive Strength ⊥ ISO 604	at 23 °C	MPa	450	600
	at 200 °C		280	300
	at 220 °C		-	290
	at 260 °C		-	250
Shock Resistance ∥ to bedding plane ISO 179		kJ/m ²	50	-
Flexural Strength ISO 178 ⊥		MPa	360	-
Tensile Strength ∥ ISO 527		MPa	280	-
Elastic Modulus DIN 7735		MPa	-	20,000
Dielectric Properties				
Dielectric Strength at 90 °C ⊥			13 kV/mm IEC 60243	40 kV DIN 53481
Breakdown Voltage at 90 °C ∥ IEC60243		kV/25 mm	70	-
Comparative Tracking Index IEC60112			150	-
Chemical and Biological Properties				
Linear Thermal Expansion Coefficient		10 ⁻⁶ /K	0,01 - 0,02	-
Water Absorption		%	< 0,2 ISO 62	0,05 DIN 7735
Resistance to Oils			good	Excellent
Resistance to Chemicals			Excellent	Excellent
Arc Resistance			-	Excellent



Composite Materials

MC5000-HT Mica-Silicone, up to 700 °C

Mica is a mineral which is primarily comprised of aluminium silicate and potassium. It is characterized by its laminated structure, which is typical of phyllosilicates, its metallic lustre and its high resistance to heat. The properties and uniform qualities of micas make them ideal candidates for thermal insulation applications.

Mica-based products deliver high mechanical strength and high compressive resistance, even at high temperatures. They show exceptional resistance to flames, arcing and electrical erosion.

MC5000-HT mica is comprised of 90 % phlogopite mica and 10 % silicone binder. It is resistant to a continuous temperature of 700 °C. Mica panels can be used as a replacement for products containing asbestos.

Important: it is necessary for MC5000-HT to be compressed between two plates or flanges. Mechanical compression prevents any crumbling of the product in response to the action of temperature, given that the silicone binder deteriorates at temperatures in excess of 300 °C, and replacement of the component will therefore be necessary after dismantling.

Available Products

Product	Item N°	Type	Board Dimensions	Tolerances
MC-5000HT	080-0011	Board	For every thickness: 1,220 x 1,020 mm 1,200 x 1,000 mm	±0,7 % thickness 2 mm -5 % to +7% from 2.1 to 6 mm
			For 5, 10 and 15 mm thickness: 2,420 x 1,020 mm	-4 % to +5 % from 6.1 to 40 mm -2 % to +3% from 40.1 to 100 mm

Customized designs are available on request

**Composite Materials****Technical Data**

Property		Unit	MC-5000HT
Item N°			080-0011
Composition			90 % phlogopite mica 10 % silicon resin
Density		kg/cm ³	2,200
			Thermal Properties
Max. Operating Temperature		°C	750
Max. Peak Temperature		°C	1,000
Weight Loss			V-0 (UL 94) < 2 % IEC 371-2
Thermal Conductivity ⊥ to the board	at 23 °C	W.m ⁻¹ .K ⁻¹	0.30
	at 100 °C		0.31
	at 200 °C		0.32
	at 300 °C		0.345
			Mechanical Properties
Compressive Strength ⊥ to the board ISO 604	at 20 °C	MPa	300
	at 200 °C		240
Flexural Strength IEC 371-2		MPa	120
Tensile Strength ISO 527		MPa	110
			Electrical Properties
Dielectric Strength IEC 371-2		kV/mm	25
			Chemical Properties
Water Absorption IEC 371-2		%	< 0.5
Resistance to chemicals			excellent
Thermal Expansion Coefficient		10 ⁻⁶ K ⁻¹	10



Composite Materials

Mineral-bonded products, for applications in excess of 500 °C

Our range of mineral-bonded technical composites incorporates various materials, for the optimum response to issues arising in the field. These products are resistant up to a maximum temperature of 2,000 °C.

The temperature resistance of a material is generally inversely proportional to its density, its mechanical strength and its machinability.

Calcium Silicate, up to 1,000 °C

Calcium silicate is a powder with the formula Ca_2SiO_4 . This product is essentially employed for its excellent high-temperature properties.

In block form, calcium silicate can easily be cut, chiselled, drilled, screwed and machined using specialized equipment, or even using conventional joinery tools and techniques. Any cutting installation must incorporate a dust extraction facility.

Calcium silicate is a low density material, white in colour. It has no odour or taste, and poses no known health risks. Its derivatives are highly valued for their low thermal conductivity, their high resistance to heat and their limited dimensional shrinkage.

Available Products

Product	Item N°	Board Dimensions	Thickness	Tolerances
Pro-H	080-0033	1,250 x 2,500 mm 1,200 x 3,000 from 10 mm thickness	12.7 – 16 – 20- 25 – 30 – 40 – 50 – 60 mm	-
DXP	080-0031	1,200 x 900 mm	6, 8, 10, 12, 15, 20, 25 mm	Thickness: ± 1 mm Linear: ± 4 mm
LUX	080-0032	2,500 x 1,200 mmm	4, 6, 8, 10, 12, 15, 20, 25, 30, 40 mm	Width: ± 1 mm Length: ± 1 mm Thickness: ± 0,4 mm
M1	080-0034	2,500 x 1,250 mm 1,250 x 1,200 mm	13.1 – 19.5 – 25.8 – 38.5 – 51.2 – 76.6 – 102 mm	Thickness: ± 0.4 mm Linear: ± 1 mm
M1A	080-0035	2,500 x 1,250 mm 1,250 x 1,200 mm	13.1 – 19.5 – 25.8 – 38.5 – 51.2 – 76.6 – 102 mm	Thickness: ± 0,4 mm Linear: ± 1 mm
P1100 S	080-0036	2,500 x 1,250 mm	20, 25, 30, 40, 50, 60 mm	Tolerances: Thickness: ± 1.3 mm Length and Width: ± 1.5 mm
D1000C	080-0037	1,500 x 1,250 mm	10, 12, 15, 20, 25, 30, 40, 50, 75, 100 mm	Thickness: 0 / + 0.8 mm Length: ± 2 mm Width: 0 + 20 mm



Composite Materials

Property		Unit	Pro-H	DXP	LUX	M1	M1A	P1100 S	D1000C
Item N°			080-0033	080-0031	080-0032	080-0034	080-0035	080-0036	080-0037
Composition			Ca ₂ O ₄ Si	SiO ₂ + CaO fiberglass	SiO ₂ + CaO: 97 %	SiO ₂ : 45 - 55 % CaO: 38 - 52 % Al ₂ O ₃ : 1.4 % Fe ₂ O ₃ : < 1.1 % LOI: < 5 %		SiO ₂ + CaO	SiO ₂ + CaO: 91 %
Density		kg/m ³	870	1,800	950	850	970	300	1,050
Thermal Properties									
Max. Temperature		°C	-	700 900 peak	900 1,000 peak	1,000	1,000	-	1,000
Thermal Conductivity	20 °C	W.m ⁻¹ .K ⁻¹	0.175	-	-	-	-	-	-
	200 °C		-	0.38	0.26	0.24	0.25	0.07	0.27
	400 °C		-	0.34	0.25	0.25	0.26	0.08	0.29
	600 °C		-	0.32	0.25	0.25	0.27	0.09	0.31
	750 °C		-	-	0.25	0.26	0.27	0.10	0.35
Fire Classification EN 13501			fireproof	-	fireproof	-	-	-	-
Specific Heat Capacity		J K ⁻¹ kg ⁻¹	-	1.05	1.03	0.96	0.97	1.03	0.9 – 1.1
Thermal Expansion Coeff.		10 ⁻⁶ K ⁻¹	-	6.6	7.3 (20 - 800 °C)	6 - 7 (20 - 750 °C)	6 - 7 (20 - 750 °C)	5.4 (20 - 400 °C)	4.3 ⊥ 5.3 ∥ (20 - 750 °C)
Mechanical Properties									
Compressive Strength at 200 °C		MPa	9.3	185	25	18	30	2.5 ⊥	28
Cold Flexural Strength		MPa	4.5	45	7	> 6	8	1.5 longit.	15
Hardness		Shore D				-	-	-	70
Shrinkage (Length / Wide)	at 750 °C 12 hr	%	-	0.5	-	0.02	0.01	-	0.3 - 2
	at 1,000°C 12 hr		-	-	0.8 (24 h)	-	-	< 1.5	0.35 – 2.5
Electrical Properties									
Dielectric Strength		kV/mm	-	1.8	-	-	-	-	3.9
Arc Resistance		s	-	> 420 (40 mA)	-	-	-	-	345 (30 mA)
Water Content		%	-	-	< 5	-	-	-	-



Composite Materials

Nano-T Ultra Nanoporous Silica, up to 1,050 °C

Nanoporous silica originates from applied research in ceramic nanostructures. This is an exceptionally lightweight insulating product, with an extremely low coefficient of thermal conduction. It is primarily comprised of silica, to which opacifying agents are added for the minimization of infrared radiation.

Nanoporous silica is non-combustible and is graded A1 in the Euroclass European fire performance rating. It is insensitive to thermal impacts. It must be protected against liquids, which may destroy its nanoporous structure.

It is possible to protect this material using various types of packaging, in the interests of facilitating its use and conservation. For example, PE film or aluminium foils may be employed. This packaging also protects the product against mould.

Available Products

Product	Item N°	Type	Dimensions	Thickness
Nano-T Ultra	115-1000	Board	1,000 x 650 mm and 1,320 x 1,000 mm	10, 12,15, 17, 20, 25, 30, 35, 40, 45, 50 mm
Customised designs are available on request				

Storage

Nano-T Ultra: This product can be stored indefinitely in a dry environment; it can resist humidity, provided that condensation is prevented.

Technical Data

Property		Unit	Nano-T Ultra
Item N°			115-1000
Chemical Composition, after firing	SiO ₂	%	75-85
	SiC		12-20
	Other		3-10
Ignition Loss		%	< 1.5
Density		kg/m ³	230
Fire Classification		°C	950
Cold Compressive Strength		MPa	0.42
Shrinkage	Both side at 950 °C, 24 hr	%	< 3
	One side at 950 °C, 12 hr		< 0.5
Thermal Conductivity	at 200 °C	W.m ⁻¹ .K ⁻¹	0.02
	at 400 °C		0.027
	at 600 °C		0.034
	at 800 °C		0.044



Composite Materials

ZYZ and ZYC Zirconium Oxide Fibre, up to 1.700 °C

Zirconium Oxide Boards Type ZYZ and ZYC are rigid, refractory structures composed of yttria stabilized zirconia fibres that are bonded with silica. This unique composition provides ZYZ insulation with the low thermal conductivity of zirconia fibres combined with the strength and machinability of a silica bonded material. ZYZ is evenly bonded, allowing it to be machined to tight tolerances and intricate shapes.

Available Products

Product	Type	Dimensions
ZYC	Cylinder	Length: 152.4 and 304.8 mm Inner and outer diameter: from 25.4 x 50.8 mm to 304.8 x 330.2 mm
ZYZ	Board	Dimensions: 304.8 x 304.8 mm Thickness: 12.7 - 19.0 - 25.4 - 38.1 mm

Technical Data

Property		Unit	ZYC	ZYZ-3	ZYZ-6
Nominal Composition	ZrO ₂ *	Wt. %	85	85	85
	Y ₂ O ₃		10	10	10
	SiO ₂		5	5	5
Colour			white	white	white
Bulk Density		g/cm ³	0,48	0,48	0,96
Porosity		%	91	91	85
Thermal Properties					
Max. Operating Temperature**		°C	1,650	1,650	1,650
Peak Temperature		°C	1,700	1,700	1,700
Melting Point		°C	2,200	2,200	2,200
Dilatometric Softening Temperature at 10 psi		°C	950	1,250	1,275
Thermal Conductivity	400 °C	Wm ⁻¹ .K ⁻¹	0.08	0.08	0.16
	800 °C		0.11	0.11	0.20
	1,100 °C		0.14	0.14	0.23
	1,400 °C		0.19	0.19	0.25
	1,650 °C		0.23	0.23	0.27
Mechanical Properties					
Flexural Strength		MPa	0.55	0.28	1.74
Compressive Strength at 10 % compression		MPa	0.21	0.39	0.92
Thermal Expansion Coefficient (20 - 1,425 °C)		10 ⁻⁶ .K ⁻¹	9	9	9
Linear Shrinkage (⊥ to thickness)	1 hr at 1,650 °C	%	2.5	1.7	1.6
	24 hr at 1,650 °C		4	2.3	2.6
Chemical Properties					
Outgassing in Vacuum			Nil	Nil	Nil

*1-2 % weight hafnia (HfO₂) occurs naturally with zirconia (ZrO₂) and does not affect performance.

**Maximum use temperature is dependent of variables such as chemical environment and stresses; both thermal and mechanical.



Composite Materials

SIZAL[®], up to 1,800 °C

SIZAL[®]CELL is a range of non-fibrous insulation products manufactured from alumina microspheres. Ultra-light, SIZAL[®]CELL is designed for high-temperature applications up to 1,800 °C.

Available Products

Product	Type	Standard Dimensions	Max. Dimensions*
1260-380 1430-380 1540-380 1650-420 1705-420	Board	900x600x50 mm	650x480x70 mm 960x650x50 mm
1750-700	Board	600x400x25 mm	-

**Customized designs are available on request.
*Min. order required**

SIZAL[®]BOARD is a range of rigid high-temperature insulation. These products are made of silica and alumina, bonded by an inorganic binder. All SIZAL[®]BOARD products can be delivered pre-calcined. Cooking parts at more than 350 °C eliminates all traces of organic binders that may be present in the materials. This operation avoids gas emissions and potential pollution during more sensitive applications.

Available Products

Product	Type	Thickness	Dimension
1500-300 1600-400	Board	25, 40, 50, 100 mm	900 mm x 600 mm*
1650-400 1850-400P		20, 25, 40, 50, 100 mm	
1850-500		20, 25, 40, 50 mm	

Customized designs are available on request.



Composite Materials

		SIZAL®CELL						
Property	Unit	1260-380	1430-380	1540-380	1650-420	1705-420	1750-700	
Item N°		223-2300	223-2600	223-2800	223-3000	223-3100	223-3200	
Chemical Composition	Al ₂ O ₃	%	50.2	59.8	65,3	70.4	80.5	99.5
	SiO ₂		46.4	38.1	32,1	28.5	17.8	< 0.3
	Other		3.4	2.1	2,6	1.1	1.7	< 0.2
Mineral Phase		Mullite Corundum Anorthite	Mullite Corundum Anorthite	Mullite Corundum	Mullite + Corundum	Mullite + Corundum	Alumina	
Density	kg/m ³	350	380	380	420	420	700	
Open Porosity	%	88	87	86	86	87	83	
Thermal Property								
Classification Temperature	°C	1,260	1,430	1,540	1,650	1,700	1,700	
Max. Operating Temperature	°C	1,160	1,330	1,440	1,550	1,600	1,650	
Peak Temperature	°C	1,210	1,380	1,490	1,600	1,650	1,750	
Thermal Conductivity	200 °C	W.m ⁻¹ .K ⁻¹	0.13	0.15	0.2	0.18	0.17	-
	400 °C		0.14	0.17	0.21	0.21	0.19	-
	600 °C		0.17	0.19	0.22	0.24	0.21	-
	800 °C		0.19	0.22	0.24	0.26	0.25	0.68
	1,000 °C		0.21	0.25	0.27	0.3	0.28	0.75
	1,200 °C		-	0.28	0.3	0.33	0.31	0.80
Mechanical Property								
Cold Compressive Strength	MPa	1.2	2.6	3.1	4.2	2.9	7	
Cold Tear Resistance	MPa	0.7	0.9	2.0	2.6	1.8	3	
Linear Shrinkage after 24 h at Peak Temperature	%	0.3	0.33	0.12	0.43	0.29	-	

**Composite Materials**

SIZAL®BOARD								
Property		Unit	1500/300	1600/400	1650/400*	1750/400*	1850/400	1850/500
Item N°			057-1500	057-1600	057-1650	057-1750	057-1800	057-1850
Chemical Composition	SiO₂	%	37	35	28	28	20	15
	Al₂O₃		63	65	72	72	80	85
Density		kg/m³	300	400	400	400	400	500
Classification Temperature		°C	1,500	1,600	1,650	1,750	1,850	1,850
Max. Operating Temperature		°C	1,420	1,480	1,600	1,700	1,800	1,800
Linear Expansion after 24 h	1,400 °C	%	-0.4	-	-	-	-	-
	1,500 °C		-1.2	0	+0.1	0	-	-
	1,600 °C		-	-0.5	-0.2	+0.5	+0.3	0
	1,700 °C		-	-	-	-0.2	+0.5	+0.2
	1,800 °C		-	-	-	-	-0.7	-0.4
Thermal Conductivity	800 °C	W.m⁻¹.K⁻¹	0.14	0.15	0.16	0.14	0.18	0.25
	1,200 °C		0.20	0.22	0.23	0.23	0.28	0.33
	1,400 °C		-	-	0.28	0.29	0.34	0.38
Ignition Loss		%	3	3	5.1	4	6	4

*contains refractory ceramic fibres

**ZYBF and FBD Zirconium Oxide Fibre, up to 2,200 °C**

ZYBF and FBD fibres are the result of the Zircar Process which transforms an organic fibre into a ceramic one. The new fibre usually has a diameter of 6 to 10 µm and a serrated outer surface.

All zirconia bulk fibres are made of nearly 100 % zirconia phase stabilized with 10 % yttria. The yttria stabilizes the tetragonal / cubic structure by preventing the monoclinic to tetragonal crystal transformation that occurs at 1,170 °C in pure un-stabilized or insufficiently stabilized zirconia. This undesirable transformation causes an 11 % volume change in the crystal unit cell size that can cause micro-cracking and reduced physical strength in the bulk solid.

ZYBF: Yttria stabilized zirconia is an electrical semiconductor at elevated temperatures. This conductivity arises from the different valences of ionic Zr^{4+} and Y^{3+} . Electricity is conducted at elevated temperatures (700-800 °C) as oxygen ions are induced to flow through the stabilized zirconia structure. This phenomenon forms the basis of zirconia oxygen sensors.

FBD: They have extremely high stability for use as high as 2,000 °C and can be exposed to significantly higher temperatures, depending on the application. It has good hot strength up to 1,700 °C, and can be used as protection sleeve, insulation for industrial furnaces or setter for loads up to twice its weight. This product can be machined with conventional tooling.

Machinable zirconium fibre technical composites are available in the form of panels, disks or tubes, in three different densities.

Available Products

ZYBF-3 and ZYBF-6	Dimension
Square Boards	from 152.4 x 152.4 x 6.4 mm to 152.4 x 152.4 x 38.1 mm
	from 304.8 x 304.8 x 6.4 mm to 304.8 x 304.8 x 38.1 mm
The dimensions depend on the article number. Customized designs are available on request.	

FBD	Dimension
Square Boards	from 76.2 x 76.2 x 6.3 mm to 304.8 x 304.8 x 38.1 mm
Rectangular Boards	from 228,6 x 457,2 x 6,3 mm to 228.6 x 457.2 x 76.2 mm
Cylinder	from 12.7 x 19.0 x 152.4 mm to 203.2 x 254.0 x 152.4 mm
The dimensions depend on the article number. Customized designs are available on request.	



Composite Materials

Technical Data

Property		Unit	ZYFB-3	ZYFB-6	FBD
Composition	ZrO ₂ *	Wt. %	90		
	Y ₂ O ₃		10		
Typical Impurities	HfO ₂	Wt. %	1 to 2		
	SiO ₂		0.12		
	TiO ₂		0.14		
	CaO		0.09		
	MgO		0.03		
	Fe ₂ O ₃		0.04		
	Al ₂ O ₃		0.01		
	Na ₂ O		0.01		
Colour			white		
Bulk Density		g/cm ³	480	960	1,400
Porosity		%	92	84	76
Thermal Properties					
Operating Temperature**		°C	1,800	1,800	2,000
Peak Temperature		°C	2,200		
Melting Point		°C	2,590		
Dilatometric Softening Temperature		°C at 10 psi	1,180	1,240	1,400
Specific Heat Capacity		J K ⁻¹ kg ⁻¹	0.754		
Thermal Conductivity (to Thickness)	at 400 °C	W.m ⁻¹ .K ⁻¹	0.08	0.6	0.24
	at 800 °C		0.11	0.19	0.26
	at 1,100 °C		0.14	0.22	0.31
	at 1,400 °C		0.19	0.25	0.33
	at 1,650 °C		0.24	0.27	0.35
Mechanical Properties					
Flexural Strength, Normal to Fibre Plane		MPa	0.60	2.10	8.27
Compressive Strength, Normal to Fibre Plane, at 10 % compression		MPa	0.29	1.59	5.52
Thermal Expansion Coefficient RT to 1,180 °C (⊥ to Thickness)		10 ⁻⁶ .K ⁻¹	10.7		
Linear Shrinkage (⊥ to Thickness)	1 h at 1,650 °C	%	1.2	1.0	0.0
	24 hrs at 1,650 °C		2.8	1.7	0.9
Chemical Properties					
Outgassing in Vacuum			None	None	None

*1-2 % weight hafnia (HfO₂) occurs naturally with zirconia (ZrO₂) and does not affect performance.

**Maximum use temperature is dependent of variables such as chemical environment and stresses; both thermal and mechanical.

Physical variables included in this documentation are provided by way of indication only and do not, under any circumstances, constitute a contractual undertaking. Please contact our technical service if you require any additional information.