Advanced Ceramic Tubes & Insulators

For Thermocouples, RTD'S and Special Applications

CeramTec
THE CERAMIC EXPERTS

Advanced Ceramic materials

Mostly drawn in use to a specific requirement our manufactured protection tubes and insulators are primarily used within the industry of temperature measurement and control technology. CeramTec manufactures ceramic tubes for a wide range of applications. Technical ceramics manufactured by us meet the most stringent specifications and high accuracy standards.

CeramTec manufactures tubes with a diameter range of 0.5 mm through to 300 mm and a standard maximum length of 2200 mm (greater upon request).

Materials				
Pormulit®	Silicate / Al_2O_3	70.0% Al_2O_3	Porous	Max. 1500°C
Dimulit®	Mullite / Al_2O_3	60.0% Al_2O_3	Dense	Max. 1400°C
Rubalit®	Aluminum Oxide	99.7% Al_2O_3	Dense	Max. 1700°C

With more than a century of experience in development and production to draw upon, CeramTec has established itself as one the world's top companies in the field of advance ceramics. The current portfolio comprises of many different products, servicing the electrical and mechanical industries with a variety of ceramic materials.

Pormulit, a porous material composed of aluminum oxide and silicon oxide (Al_2O_3-SiO_2). The material has excellent thermal shock resistance and is mostly demanded in applications which cause the occurrence of high temperature gradients and pyrometer protection sleeves.

Dimulit, a composition on material aluminum oxide and silicon oxide (Al_2O_3-SiO_2). The material is defined by its mineralogical raw material mixture; the proportion of Al_2O_3 and SiO_2 with other additives and the resultant component after sintering. These compounds are able to lend its attributes to high strength, good thermal shock and temperature resistances.

Rubalit, a highly dense technical oxide ceramic material that can be determined by characteristics of hardness and high strength in combination with that of temperature stability. High corrosion against and wear resistance defines the material for excellent usage in various chemical applications.

PORMULIT® C 530
- Manufactured in accordance to DIN VDE 0335
- Suitable for operating temperature of less than 1500°C
- Good temperature stability and adequate chemical resistivity
- Excellent thermal shock resistance
- Resistant to chemical attack and high electrical insulation
- Good refectory material, excellent for custom forming and moulding

DIMULIT® C 610
- In accordance to standards DIN VDE 0335
- Suitable for operating temperatures of less than 1400°C
- Very good temperature stability and chemical resistance
- Good mechanical strength
- Low thermal expansion and good thermal shock resistance
- Economical material for use on temperature measurement applications
- Main products are multi-bore insulators and protection sheaths

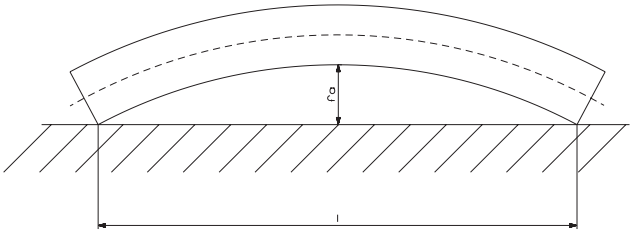
RUBALIT® C 799
- In accordance to standards DIN VDE 0335
- Suitable for temperatures of less than 1700°C
- Very high temperature stability and chemical resistance
- Recommended for extreme corrosive environments
- High mechanical strength
- High electrical resistivity

Manufacturing Tolerances Data

The manufacturing tolerances of CeramTec are in accordance with DIN 40 680. The table on this page indicates CeramTec's standard tolerances for unground ceramic tubes (mm). Tighter tolerances are subject to individual agreement.

Length mm	Straightness Tolerances [Fa] in mm
up to 30	+/- 0.15
over 30 to 40	+/- 0.20
over 40 to 50	+/- 0.25
over 50 to 60	+/- 0.30
over 60 to 70	+/- 0.35
over 70 to 80	+/- 0.40
over 80 to 90	+/- 0.45
over 90 to 100	+/- 0.50
over 100 to 110	+/- 0.55
over 110 to 125	+/- 0.60
over 125 to 140	+/- 0.70
over 140 to 155	+/- 0.80
over 155 to 170	+/- 0.85
over 170 to 185	+/- 0.90
over 185 to 200	+/- 1.00
over 200 to 250	+/- 1.25
over 250 to 300	+/- 1.50
over 300 to 350	+/- 1.75
over 350 to 400	+/- 2.00
over 400 to 450	+/- 2.25
over 450 to 500	+/- 2.50
over 500 to 600	+/- 3.00
over 600 to 700	+/- 3.50
over 700 to 800	+/- 4.00
over 800 to 900	+/- 4.50
over 900 to 1.000	+/- 5.00
over 1.000	+/- 0.5% x length

Diameter mm	Diameter Tolerances in mm
up to 4,0	+/- 0.15
over 4 to 6	+/- 0.20
over 6 to 8	+/- 0.25
over 8 to 10	+/- 0.30
over 10 to 13	+/- 0.35
over 13 to 16	+/- 0.40
over 16 to 20	+/- 0.45
over 20 to 25	+/- 0.55
over 25 to 30	+/- 0.55
over 30 to 35	+/- 1.30
over 35 to 40	+/- 1.33
over 40 to 45	+/- 1.35
over 45 to 50	+/- 1.65



Over 1.000 +/- 0.5% x length (mm).

Standard Pyrometric Tubes, Insulating Rods and Tubes

Camber

The standard camber of ceramic tubes in accordance with DIN 40 680 is a value of 0.5% of the total length. Modern production methods, as well as continuous in-process control, enable CeramTec to surpass the standard camber values.

Extruded ceramic sheaths and tubes

Various forms and shapes of extruded parts are available from CeramTec's product range. Different customer requirements demand varied tool designed to their specific applications. Ceramic insulating rods for thermo elements in accordance with EN 50113 standards, available with and without slots.

Rubalit Two Bore Insulators

No. of bores		Ø ID		Ø OD
2	x	0,2	x	1
2	x	0,3	x	1
2	x	0,33	x	1,15
2	x	0,3	x	1,2
2	x	0,35	x	1,2
	x	0,3	x	1,4
2	x	0,4	x	1,5
2	x	0,45	x	1,55
2	x	0,33	x	1,6
2	x	0,4	x	1,6
2	x	0,45	x	1,7
2	x	0,33	x	1,8
2	x	0,7	x	2
2	x	0,5	x	2,2
2	x	0,7	x	2,2
2	x	0,7	x	2,3 / 1,4
2	x	0,7	x	2,5
2	x	0,5	x	2,6
2	x	0,8	x	2,7
2	x	0,7	x	2,8
2	x	0,8	x	2,8
2	x	0,7	x	3,0 / 1,5
2	x	0,8	x	3
2	x	0,8	x	3,0 / 1,5
2	x	1	x	3,0 / 2,0
2	x	1	x	3,2
2	x	0,8	x	3,5
2	x	1	x	3,5
2	x	0,8	x	4
2	x	1	x	4
2	x	1	x	4,0 / 2,7
2	x	1,2	x	4
2	x	1,2	x	4,5
2	x	1,2	x	4,5 / 2,75
2	x	1,5	x	4,5
2	x	1,3	x	4,8
2	x	1,2	x	5
2	x	1,5	x	5
2	x	1,2	x	5,5
2	x	1,8	x	6
2	x	2	x	6
2	x	1,6	x	8
2	x	1,5	x	8,5
2	x	1,8	x	8,5
2	x	0,15	x	0,75
2	x	0,38	x	1
2	x	0,45	x	1,5
2	x	0,8	x	5
2	x	1,5	x	5,5
2	x	1,8	x	5,5
2	x	1,5	x	8
2	x	0,8	x	2,3 / 1,4

6 and more bore tubes are available on request.

Rubalit Four Bore Insulators

No. of bores		Ø ID		Ø OD
4	x	0,3	x	1,6
4	x	0,4	x	1,6
4	x	0,33	x	1,7
4	x	0,35	x	1,7
4	x	0,33	x	1,8
4	x	0,35	x	2
4	x	0,33	x	2,2
4	x	0,5	x	2,2
4	x	0,6	x	2,2
4	x	0,65	x	2,3
4	x	0,6	x	2,6
4	x	0,53	x	2,8
4	x	0,7	x	2,8
4	x	0,75	x	2,8
4	x	0,53	x	3
4	x	0,58	x	3
4	x	0,58	x	3
4	x	0,8	x	3
4	x	0,53	x	3,17
4	x	0,58	x	3,17
4	x	0,58	x	3,2
4	x	0,58	x	3,3
4	x	0,58	x	3,4
4	x	0,8	x	3,5
4	x	1	x	3,5
4	x	0,58	x	3,8
4	x	0,58	x	3,9
4	x	0,8	x	4
4	x	1	x	4
4	x	1,2	x	4
4	x	0,58	x	4,2
4	x	1,1	x	4,2
4	x	0,58	x	4,5
4	x	0,8	x	4,5
4	x	1	x	4,5
4	x	1,2	x	4,5
4	x	0,53	x	4,7
4	x	0,58	x	4,7
4	x	0,7	x	4,7
4	x	1,3	x	4,8
4	x	1	x	5
4	x	1,2	x	5
4	x	1	x	5,5
4	x	1,2	x	5,5
4	x	1,5	x	5,5
4	x	1,6	x	6
4	x	1,8	x	6
4	x	1,5	x	8
4	x	0,35	x	1,59
4	x	0,45	x	1,6
4	x	0,4	x	1,7
4	x	0,5	x	2
4	x	0,5	x	2,4
4	x	0,7	x	2,7
4	x	0,6	x	2,8
4	x	0,7	x	3
4	x	0,8	x	3,2
4	x	0,7	x	4,5
4	x	1,3	x	4,8
4	x	1,8	x	8

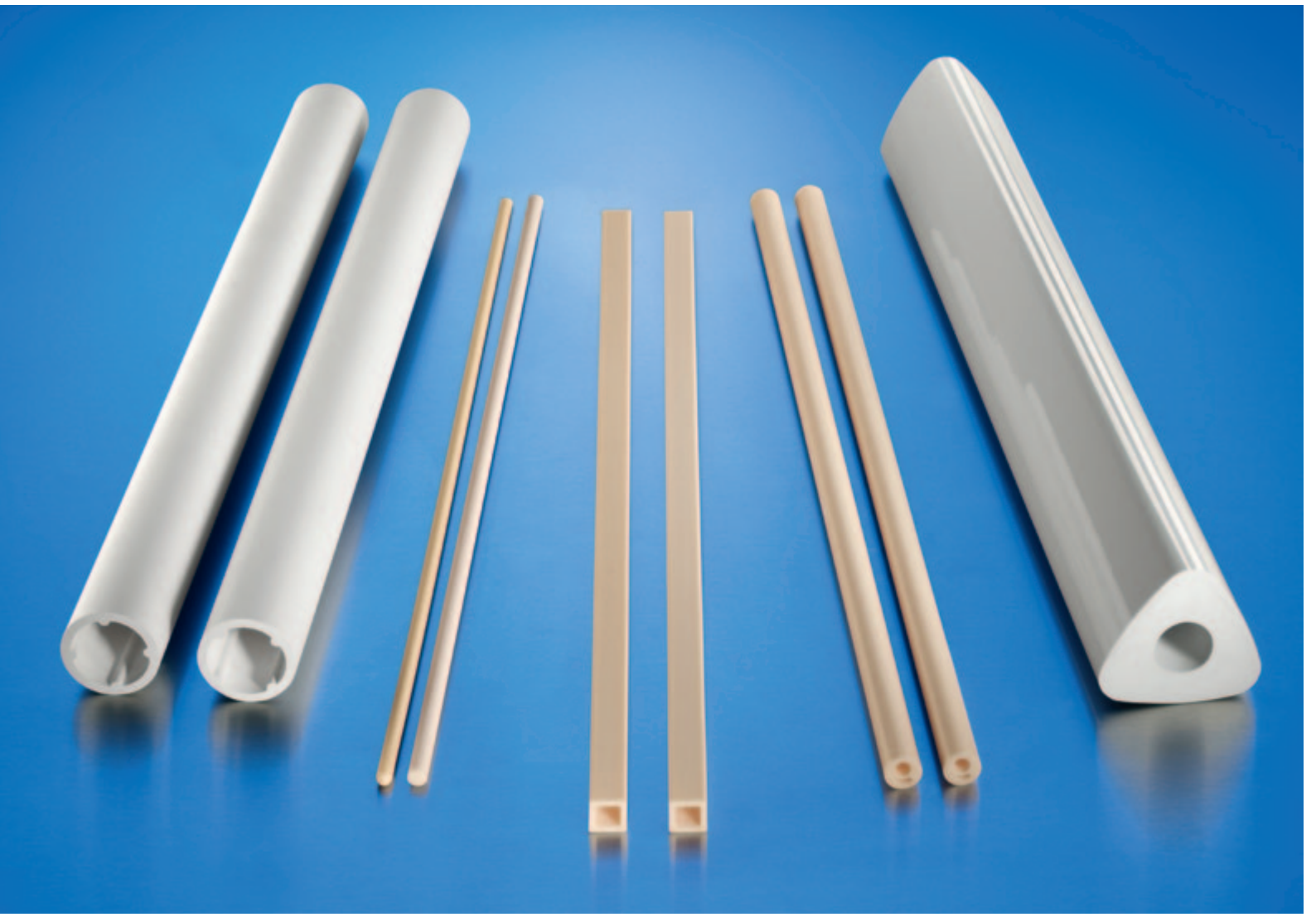
Dimulit Two Bore Insulators

No. of bores		Ø ID		Ø OD
2	x	0,35	x	1,2
2	x	0,4	x	1,35
2	x	0,4	x	1,5
2	x	0,5 / 0,6	x	1,6
2	x	0,5 / 0,6	x	1,6
2	x	0,55	x	1,8
2	x	0,6	x	1,8
2	x	0,5	x	1,9
2	x	0,6	x	1,9
2	x	0,6	x	2
2	x	0,7	x	2
2	x	0,5	x	2,2
2	x	0,7	x	2,2
2	x	0,6	x	2,6
2	x	0,8	x	2,6
2	x	0,8	x	2,7
2	x	0,75	x	2,8
2	x	0,8	x	2,8
2	x	0,65	x	3
2	x	0,7	x	3
2	x	0,8	x	3
2	x	1	x	3
2	x	1	x	3,5
2	x	1,2	x	3,5
2	x	1	x	3,8
2	x	0,7	x	3,0 / 1,5
2	x	0,8	x	4
2	x	1	x	4
2	x	1,2	x	4
2	x	1,5	x	4
2	x	1,2	x	4,5
2	x	1,5	x	4,5
2	x	1,2	x	4,5 / 2,75
2	x	1,2	x	5
2	x	1,6	x	5
2	x	1,8	x	5
2	x	1,2	x	5,5
2	x	1,5	x	5,5
2	x	1,6	x	5,5
2	x	1,8	x	5,5
2	x	1,5	x	6
2	x	1,8	x	6
2	x	2	x	6
2	x	1,8	x	7
2	x	2	x	7
2	x	2,5	x	7,0 / 4,0
2	x	1,8	x	8
2	x	2	x	8
2	x	2,5	x	8
2	x	1,8	x	8,5
2	x	2,5	x	8,5
2	x	3	x	9
2	x	3,5	x	9
2	x	3	x	9,0 / 6,0
2	x	3,5	x	10
2	x	4	x	10
2	x	3,5	x	10,5
2	x	3,5	x	11,5 / 6,5
2	x	3,8	x	11,5 / 6,5
2	x	4	x	11,5 / 6,5
2	x	3,5	x	12
2	x	4	x	12
2	x	4	x	12,0 / 8,0
3	x	1,8	x	5,3
2	x	0,65	x	2
2	x	0,5	x	2,4
2	x	0,7	x	3,0 / 2,0
2	x	1,3	x	4
2	x	1	x	4,5
2	x	1,6	x	4,5
2	x	1,5	x	5
2	x	1,5	x	5,0 / 3,0
2	x	2	x	5,71
2	x	1,6	x	6
2	x	2	x	7,5
2	x	1,5	x	8
2	x	1,5	x	8,5
2	x	2	x	8,5
2	x	2,5	x	9
2	x	2,5	x	10
2	x	2,7	x	10
2	x	4,22	x	11,91
2	x	4,5	x	15,5

Dimulit Four Bore Insulators

No. of bores		Ø ID		Ø OD
4	x	0,55 / 0,48	x	2
4	x	0,5	x	2,2
4	x	0,55	x	2,2
4	x	0,6	x	2,6
4	x	0,8	x	2,6
4	x	0,7	x	2,8
4	x	0,8	x	2,8
4	x	0,7	x	3
4	x	0,8	x	3
4	x	0,8	x	3,2
4	x	0,8	x	3,5
4	x	1	x	3,5
4	x	0,7	x	3,8
4	x	0,7	x	4
4	x	0,8	x	4
4	x	1	x	4
4	x	1,2	x	4
4	x	0,7	x	4,5
4	x	1	x	4,5
4	x	1,2	x	4,5
4	x	1,2	x	4,5
4	x	0,7	x	4,6
4	x	1,5	x	4,8
4	x	1	x	5
4	x	1,2	x	5
4	x	1,5	x	5
4	x	1,2	x	5,2
4	x	1,2	x	5,5
4	x	1,5	x	5,5
4	x	1,3	x	5,8
4	x	1,3	x	5,8
4	x	1,8	x	5,8
4	x	1,2	x	6
4	x	1,5	x	6
4	x	1,6	x	6
4	x	1,5	x	6,5
4	x	1,8	x	6,5
4	x	1,8	x	8
4	x	2	x	8
4	x	2,2	x	8
4	x	2,5	x	8
4	x	1,5	x	8,5
4	x	1,8	x	8,5
4	x	2,5	x	8,5
4	x	2,5	x	9
4	x	2,5	x	10
4	x	3	x	10
4	x	2,8	x	10,5

6 and more bore tubes are available on request.



Special tailor made geometries, e.g. rectangular, square, triangular etc.

Ceramic sheaths and tubes for thermo elements in accordance with EN 50113

Pormulit® C 530		Dimulit® C 610		Rubalit® C 799	
Ø Inside	Ø Outside	Ø Inside	Ø Outside	Ø Inside	Ø Outside
-	-	4	6	4	6
-	-	5	8	5	8
-	-	6	10	6	10
7	10	7	10	7	10
-	-	8	12	8	12
-	-	9	13	9	13
10	16	10	15	10	15
-	-	11	15	11	15
12	16	12	16	12	16
-	-	13	17	13	17
12	20	15	20	15	20
-	-	-	-	16	21
18	26	19	24	18	24
-	-	-	-	20	25

Max. available standard length 2200 mm, greater upon request.
All of the above tubes are available as closed one end (coe), open both ends (obe), customized geometries optional. Customized tolerance can be made on request.

Rubalit® C 799		Rubalit® C 799		Dimulit® C 610	
Ø Inside	Ø Outside	Ø Inside	Ø Outside	Ø Inside	Ø Outside
6 / 10	12 / 16	6	13	6	13
10 / 10	15 / 15	6	15	6	15
-	-	8	17	8	17
-	-	9	20	9	20

Material characteristics – typical data

Properties	Units	Test	Pormulit®	Dimulit®	Rubalit®
DIN VDE 0335 / IEC 672	-	-	C 530	C 610	C 799
Color	-	-	white	white	off white
Specific gravity	kg/dm^3	ASTM C 20	2.3	2.8	3.85
Water absorption	%	ASTM C 373	10	0	0
Hardness rockwell	R 45 N	ASTM E 18	-	-	80
Flexural strength	N/mm^2	ASTM F 417	120	200	360
Max. Temp. use	°C	-	1500	1400	1700
Thermal conductivity	W/mK	ASTM C 408	1.5	4	28
Thermal expansion / Linear coefficient					
20 – 100°C	x 10^{-6}/°C	ASTM 372	3.6	4.5	5.4
20 – 300°C	-	-	5.0	5.2	6.5
20 – 600°C	-	-	5.6	5.8	7.7
20 – 1000°C	-	-	6.4	6.7	8.5
Dielectric constant	-	ASTM D 150	-	-	10
Dielectric strength	kV/mm	ASTM D 116	-	-	> 10
Dielectric factor	x 10^{-3}	ASTM D 150	-	-	0.2
Volume resistivity					
200°C	Ohm x cm	ASTM D 257	-	-	10^{15}
400°C	-	-	-	-	10^{12}
600°C	-	-	-	-	10^{11}

Material compound – typical data

The grade of aluminum oxide used in all our materials is Alpha: α-Al_2O_3

Properties	Unit	Pormulit®	Dimulit®	Rubalit®
Aluminum oxide	Al_2O_3	70%	60%	> 99.7%
Silicon oxide	SiO_2	28%	37%	0.05%
Ferric oxide	Fe_2O_3	0.5%	0.6%	0.06%
Magnesium oxide	MgO	-	0.15%	0.15%
Calcium oxide	CaO	-	0.025%	0.025%

CeramTec
THE CERAMIC EXPERTS

CeramTec GmbH
Chemical Applications Division
CeramTec-Weg 1
95615 Marktredwitz
Germany

Phone: +49 9231 69-215
+49 9231 69-667
Fax: +49 9231 69-217
+49 9231 69-68667
chemical_applications@ceramtec.de
www.ceramtec.com

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