

3DMIX

BY 3DCERAM



**Ceramics
for 3D printing**

**Technical
datasheets**

3DCERAM

27 rue du Petit Theil - 87280 LIMOGES

Tél. +33 (0) 5 55 04 10 90 - info@3dceram.com

ALUMINIUM NITRIDE

✔ Properties

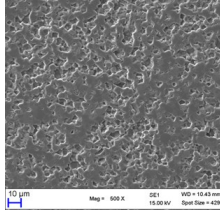
- ✔ High thermal conductivity
- ✔ Electrical insulation
- ✔ Good mechanical strength

✔ Application

- ✔ Electronics industry



ALUMINIUM NITRIDE

		Values
Microstructure		
Densification rate	%	97
Density	g/cm ³	3.22
Grain size after sintering	µm	< 5
SEM picture		
Mechanical properties		
4-pt bending strength	MPa	270
Theoretical Young modulus	GPa	368
Thermal properties from -50°C to 60°C		
Thermal conductivity at RT	W/m.K	163.1
Thermal expansion coefficient	at -50°C	1.84
	at 20°C	2.89
	at 60°C	3.38
10 ⁻⁶ .K ⁻¹		
Non contractual data for reference only - V24102019		

SILICON NITRIDE

Silicon nitride is one of the hardest and most resistant ceramics.

✔ Properties

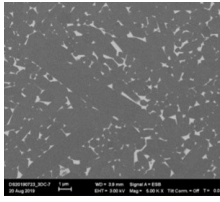
- ✔ Good resistance to thermal shocks
- ✔ Good resistance to wear
- ✔ Mechanical properties
- ✔ Low wettability against molten metals
- ✔ Good electrical insulation
- ✔ Resistance to corrosion (liquids and gas)

✔ Application

- ✔ Semi conductor
- ✔ Heating tubes
- ✔ Pump and valves components



SILICON NITRIDE

		Values
Microstructure		
Densification rate	%	>97
Open porosity	%	<2.5
Density	g/cm ³	> 3.13
SEM picture		
Mechanical properties		
4-pt bending strength	MPa	881
Weibull modulus		11
Theoretical Young modulus	GPa	290
Thermal properties from -50°C to 60°C		
Thermal conductivity at RT		W/m.K 23.6
Thermal expansion coefficient	at -50°C	0.67
	at 20°C	1.23
	at 60°C	1.52
10 ⁻⁶ .K ⁻¹		
Non contractual data for reference only - V24102019		

SILICORE

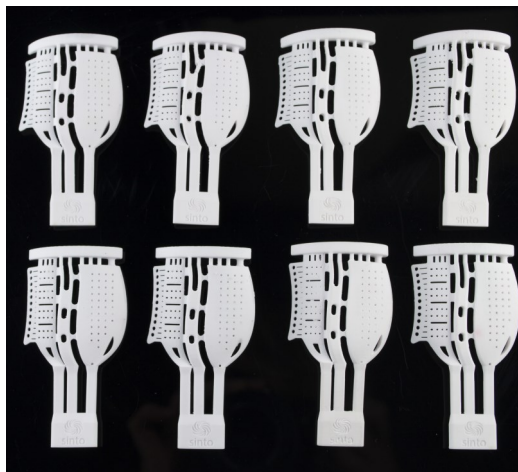
Silica based ceramic, our mix for foundry cores.

✔ Properties

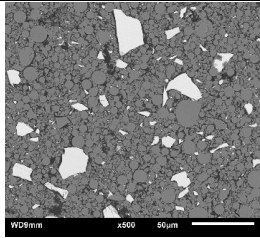
- ✔ High mechanical resistance
- ✔ Porous ceramic, good leachability
- ✔ Very stable at high temperature
- ✔ Compatible with complex shapes like cores
- ✔ Used with all alloys except cobalt

✔ Application

- ✔ Foundry cores



SILICORE

		Values
Microstructure		
<i>Porosity can be adjusted according to customer's needs</i>		
Porosity	%	29
Density	g/cm ³	1.77
SEM picture		
Mechanical properties at RT		
3-pt bending strength	MPa	15.4
General properties		
Cristobalite content	%	69
Roughness (Ra)	µm	1.3
Dilatation max (RT - 1500°C)	%	1.42
Shrinkage max (1500°C)	%	0.20
Non contractual data for reference only - V24102019		

ALUMINA TOUGHENED ZIRCONIA

✓ Properties

The ceramic ATZ combines both Alumina (20%) and Zirconia (80%) ceramics in one. The mix of these two combined offers several properties :

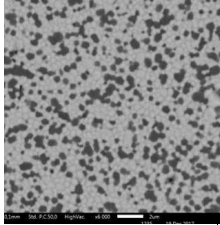
- ✓ Great hardness and tenacity
- ✓ Biocompatibility
- ✓ Resistance to wear and thermal shock

✓ Applications

- ✓ Implants
- ✓ Teeth
- ✓ Wear resistant parts



ALUMINA TOUGHENED ZIRCONIA

		Values
Microstructure		
Densification rate	%	>99
Density	g/cm ³	>5.2
Grain size after sintering	μm	<0.5
SEM picture		
Mechanical properties		
4-pt bending strength	MPa	1094
Weibull modulus		5.8
Theoretical Young modulus	GPa	220
Thermal properties from -50°C to 60°C		
Thermal conductivity at RT	W/m.K	5,4
Thermal expansion coefficient	at -50°C	7,50
	at 20°C	7,94
	at 60°C	8,33
10 ⁻⁶ .K ⁻¹		
Non contractual data for reference only - V19102018		

CORDIERITE

✔ Properties

The cordierite is a magnesium alumina silicate material and has different properties :

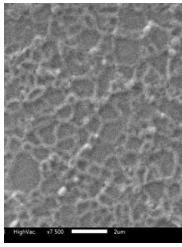
- ✔ Low CTE
- ✔ Low thermal conductivity
- ✔ Wear resistant
- ✔ Good for vacuum application

✔ Applications

- ✔ Optical parts for aerospace
- ✔ Metrology



CORDIERITE

		Values	
Microstructure			
Densification rate	%	>98	
Density	g/cm ³	>2.5	
Grain size after sintering	μm	0.89	
SEM picture			
Mechanical properties			
4-pt bending strength	MPa	150	
Weibull modulus		6.5	
Theoretical Young modulus	GPa	140	
Thermal properties from -50°C to 60°C			
Thermal conductivity at RT	W/m.K	3.8	
Thermal expansion coefficient	at -50°C	10 ⁻⁶ .K ⁻¹	-0.87
	at 20°C		-0.10
	at 60°C		0.22
Non contractual data for reference only - V19102018			

ZIRCONIA 8Y

✔ Properties

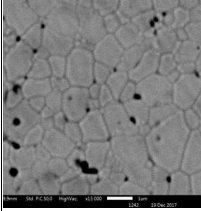
- ✔ Ionic conductivity
- ✔ Oxygen-ion conductivity
- ✔ Heat insulating

✔ Applications

- ✔ Fuel cell



ZIRCONIA 8Y

		Values
Microstructure		
Densification rate	%	>99
Density	g/cm ³	5.79
Grain size after sintering	μm	0.73
SEM picture		
General Properties		
Ionic conductivity	$\sigma_T = 17 \text{ S.cm}^{-1} \cdot \text{K}$ (T = 800°C) $\sigma_T = 3 \text{ S.cm}^{-1} \cdot \text{K}$ (T = 600°C)	
Non contractual data for reference only - V19102018		

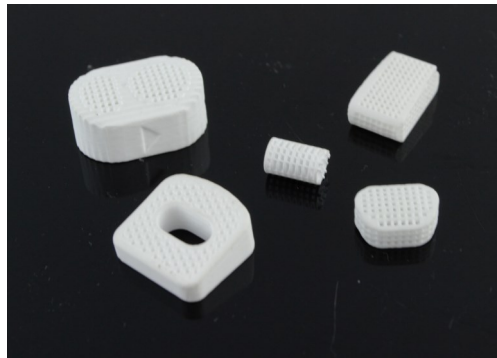
TRICALCIUM PHOSPHATE

✔ Properties

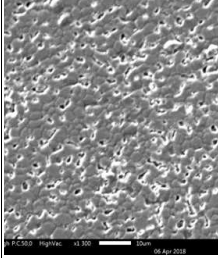
- ✔ Biocompatible
- ✔ Bioresorbable

✔ Applications

- ✔ Implants



TRICALCIUM PHOSPHATE

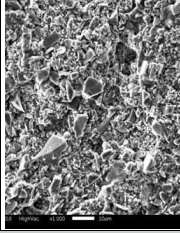
		Values
Microstructure		
<i>Density can be adjusted according to customer's needs</i>		
Densification rate	%	80.7
Density	g/cm ³	2.47
Grain size after sintering	µm	2.8
SEM picture		
General Properties		
<ul style="list-style-type: none"> - Presence of hydroxyapatite measured by X ray diffraction bewteen 0% and 5%. - No calcium pyrophosphate seen by infrared analysis. - Ca/P ratio =1.503 		
Non contractual data for reference only - V19102018		

FUSED SILICA

- ✔ **Properties**
 - ✔ Good leachability
- ✔ **Applications**
 - ✔ Foundry cores



FUSED SILICA

		Values
Microstructure		
<i>Porosity can be adjusted according to customer's needs</i>		
Porosity	%	40
Density	g/cm ³	1.36
SEM picture		
Mechanical properties at RT		
3-pt bending strength	MPa	16.7
General Properties		
Cristobalite content (mass)	%	2
Roughness (Ra)	µm	1.3
Dilatation max (RT -1500° C)	%	0.07
Shrinkage before 1500°C	%	4.61
Shrinkage at 1500°C	%	0.11
Non contractual data for reference only - V19102018		

ZIRCONIA 3Y

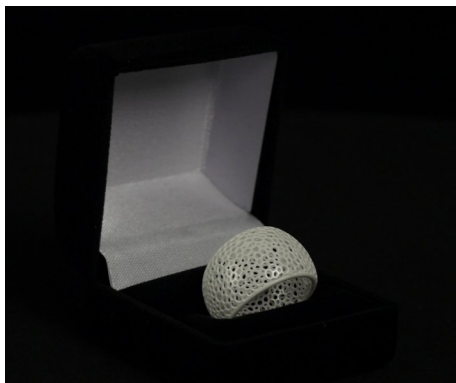
For non medical use

✔ Properties

- ✔ Excellent mechanical properties
- ✔ Chemical inertness
- ✔ High hardness

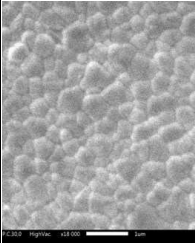
✔ Applications

- ✔ Jewelry
- ✔ Watches
- ✔ Biomedical devices
- ✔ Biomedical implants
- ✔ Electronic equipment



ZIRCONIA 3Y

For non medical use

		Values
Microstructure		
Densification rate	%	>99.5
Density	g/cm ³	>5.95
Grain size after sintering	μm	<0,5
SEM picture		
Mechanical properties		
4-pt bending strength	MPa	950
Weibull modulus		9
Theoretical Young modulus	GPa	200
Vickers hardness	GPa	12.6
Shear modulus	GPa	79.8
Compressive strength	MPa	2070
Thermal properties from -50°C to 60°C		
Thermal conductivity at RT	W/m.K	3.3
Thermal expansion coefficient	at -50°C	8.59
	at 20°C	9.10
	at 60°C	9.34
10 ⁻⁶ .K ⁻¹		
Non contractual data for reference only - V19102018		

HYDROXYAPATITE

✔ Properties

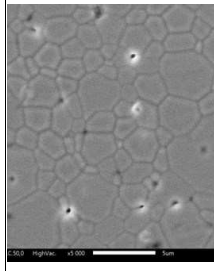
- ✔ Biocompatibility
- ✔ Excellent bioactivity
- ✔ Good osseointegration

✔ Applications

- ✔ Tibial osteotomy wedges
- ✔ Intervetebral cages
- ✔ Cranial implants
- ✔ Bone substitute
- ✔ Spine implants
- ✔ Orthopedic implants



HYDROXYAPATITE

		Values
Microstructure		
Densification rate	%	>96
Density	g/cm ³	>1.5
Grain size after sintering	μm	2
SEM picture		
Mechanical properties		
4-pt bending strength	MPa	107
General Properties		
Ca/P ratio		1.65 to 1.82
Foreign phases (CaO, TCP, alpha, TCP beta, TTCP)	%	≤5
Cristallinity	%	>95
Heavy metals	ppm	<30
Non contractual data for reference only - V19102018		

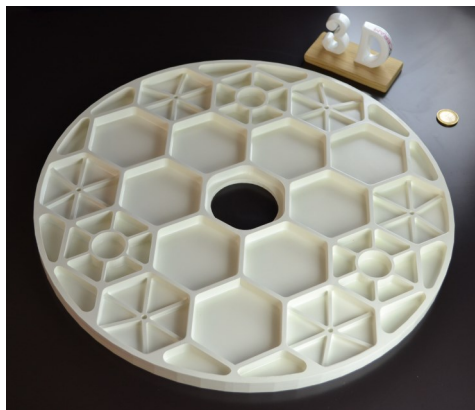
ALUMINA

✔ Properties

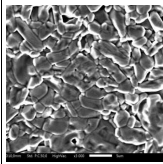
- ✔ Good mechanical strength
- ✔ Good thermal conductivity
- ✔ High electrical resistivity
- ✔ High hardness
- ✔ Good wear resistant
- ✔ Chemically inert

✔ Applications

- ✔ Electrical insulators
- ✔ Laboratory devices
- ✔ Telecommunication equipment
- ✔ Electronical devices
- ✔ Spatial
- ✔ Foundry cores
- ✔ Optical instruments

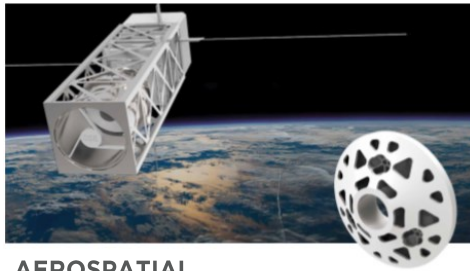


ALUMINA

		Values	
Microstructure			
Density	g/cm ³	>3.9	
Grain size after sintering	μm	2.2	
SEM picture			
Mechanical properties			
4-pt bending strength	MPa	397	
Weibull modulus		14.9	
Theoretical Young modulus	GPa	300	
Vickers hardness	GPa	16.4	
Fracture toughness	MPa. m ^{1/2}	4	
Thermal properties from -50°C to 60°C			
Thermal conductivity at RT	W/ m.K	23.3	
Thermal expansion coefficient	at -50°C	10 ⁻⁶ .K ⁻¹	3.74
	at 20°C		4.98
	at 60°C		5.51
Non contractual data for reference only - V19102018			



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