3DMIX

BY 3DCERAM

Ceramics for 3D printing

Technical datasheets

3DCERAM

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ALUMINIUM NITRIDE

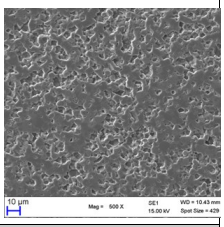
Properties

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

Application

- ✓ Electronics industry

ALUMINIUM NITRIDE

			Values
Microstructure			
Densification rate		%	97
Density		g/cm³	3.22
Grain size after sintering		µm	< 5
SEM picture			
Mechanical properties			
4-pt bending strength		MPa	270
Theorical 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	$10^{-6}.K^{-1}$	1.84
	at 20°C		2.89
	at 60°C		3.38

Non contractual data for reference only - V24102019

SILICON NITRIDE

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

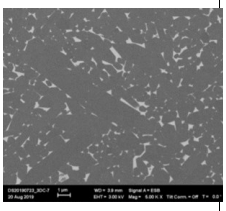
Properties

- ✓ Good resistance to thermal shocks
- ✓ Good resistance to wear
- ✓ Mechanical properties
- ✓ Low wetability 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/cm³	> 3.13
SEM picture			
Mechanical properties			
4-pt bending strength		MPa	881
Weibull modulus			11
Theorical 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	$10^{-6}.K^{-1}$	0.67
	at 20°C		1.23
	at 60°C		1.52

Non contractual data for reference only - V24102019

SILICORE

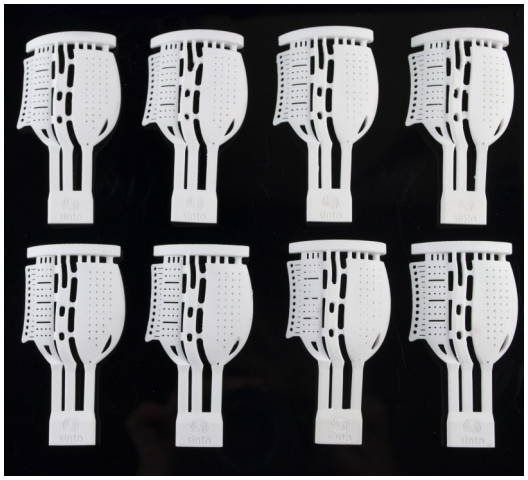
Silica based ceramic, our mix for foundry cores.

Properties

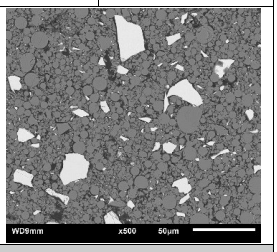
- ✓ High mechanical resistance
- ✓ Porous ceramic, good leachability
- ✓ Very stable at high temperature
- ✓ Compatible with complex shapes like cores
- ✓ Used with all alloys except cobalt

Application

- ✓ Foundry cores



SILICORE

		Values
Microstructure *Porosity can be adjusted according to customer's needs*		
Porosity	%	29
Density	g/cm³	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

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ALUMINA TOUGHENED ZIRCONIA

Properties

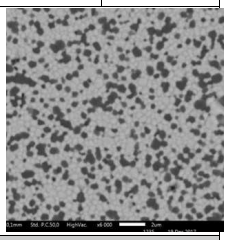
The ceramic ATZ combines both Alumina (20%) and Zirconia (80%) ceramics in one. The mix of these two combined offers several properties :

- ✓ 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/cm³	>5.2
Grain size after sintering		µm	<0.5
SEM picture			
Mechanical properties			
4-pt bending strength		MPa	1094
Weibull modulus			5.8
Theorical 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	$10^{-6}.K^{-1}$	7,50
	at 20°C		7,94
	at 60°C		8,33

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CORDIERITE

Properties

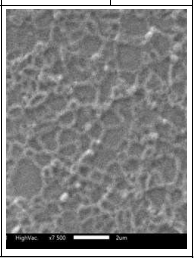
The cordierite is a magnesium alumina silicate material and has different properties :

- ✓ 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/cm³	>2.5
Grain size after sintering		µm	0.89
SEM picture			
Mechanical properties			
4-pt bending strength		MPa	150
Weibull modulus			6.5
Theorical 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

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ZIRCONIA 8Y

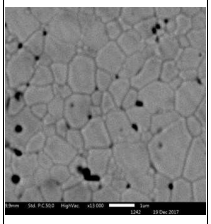
Properties

- ✓ Ionic conductivity
- ✓ Oxygen-ion conductivity
- ✓ Heat insulating

Applications

- ✓ Fuel cell

ZIRCONIA 8Y

		Values
Microstructure		
Densification rate	%	>99
Density	g/cm³	5.79
Grain size after sintering	µm	0.73
SEM picture		
General Properties		
Ionic conductivity	σ T = 17S.cm-1.K (T = 800°C) σ T = 3S.cm^{-1}.K (T = 600°C)	

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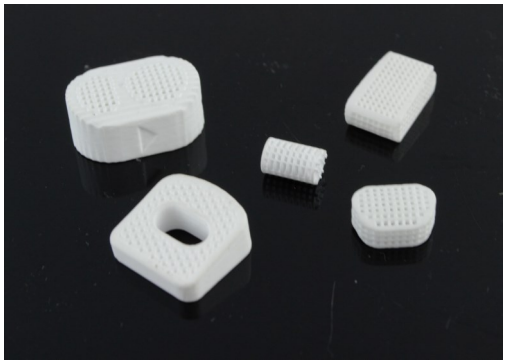
TRICALCIUM PHOSPHATE

Properties

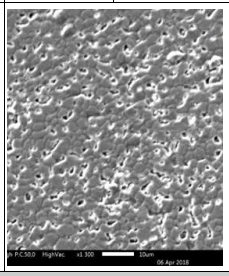
- ✓ Biocompatible
- ✓ Bioresorbable

Applications

- ✓ Implants



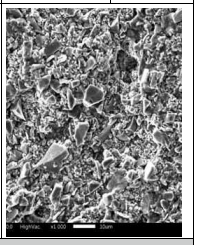
TRICALCIUM PHOSPHATE

		Values
Microstructure		
Density can be adjusted according to customer's needs		
Densification rate	%	80.7
Density	g/cm³	2.47
Grain size after sintering	µm	2.8
SEM picture		
General Properties		
- 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		
Porosity can be adjusted according to customer's needs		
Porosity	%	40
Density	g/cm³	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		

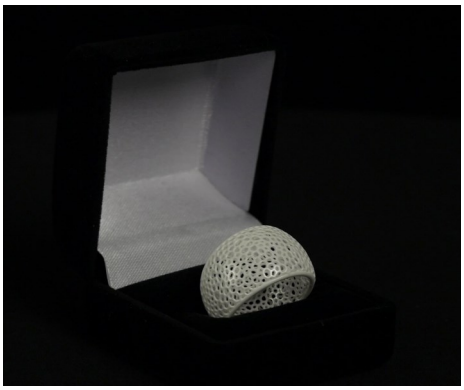
ZIRCONIA 3Y

Properties

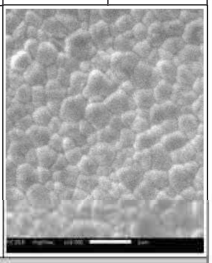
- ✓ Excellent mechanical properties
- ✓ Chemical inertness
- ✓ High hardness

Applications

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



ZIRCONIA 3Y

			Values
Microstructure			
Densification rate		%	>99.5
Density		g/cm³	>5.95
Grain size after sintering		µm	<0,5
SEM picture			
Mechanical properties			
4-pt bending strength		MPa	950
Weibull modulus			9
Theorical 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	$10^{-6}.K^{-1}$	8.59
	at 20°C		9.10
	at 60°C		9.34

Non contractual data for reference only - V19102018

HYDROXYAPATITE

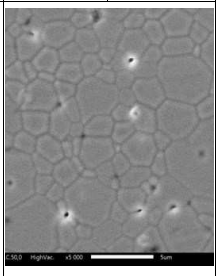
Properties

- ✓ 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/cm³	>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

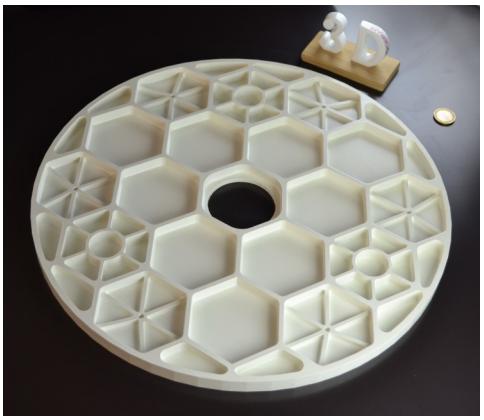
ALUMINA

Properties

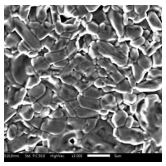
- ✓ Good mechanical strength
- ✓ Good thermal conductivity
- ✓ High electrical resistivity
- ✓ High hardness
- ✓ Good wear resistant
- ✓ Chemically inert

Applications

- ✓ Electrical insulators
- ✓ Laboratory devices
- ✓ Telecommunication equip-ment
- ✓ Electronical devices
- ✓ Spatial
- ✓ Foundry cores
- ✓ Optical instruments

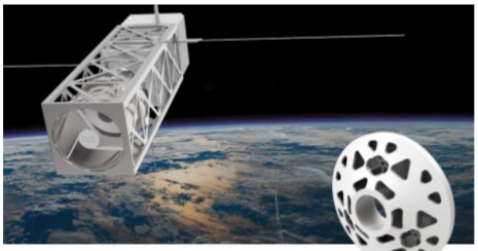


ALUMINA

			Values
Microstructure			
Density		g/cm³	>3.9
Grain size after sintering		µm	2.2
SEM picture			
Mechanical properties			
4-pt bending strength		MPa	397
Weibull modulus			14.9
Theorical 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

OUR SERVICES



AEROSPATIAL

FOUNDRY CORES

BIOMEDICAL