

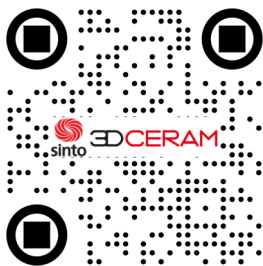
# 3DMIX

BY 3DCERAM



**Ceramics  
for 3D printing**

**Technical  
datasheets**



# SILICORE DS/SX

## ✔ 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



Available on C100 EASY and  
C1000 FLEXMATIC

## SILICORE DS/SX

|                                                        |               | Values    |
|--------------------------------------------------------|---------------|-----------|
| <b>Microstructure</b>                                  |               |           |
| Silica/Zircon                                          |               | 80/20     |
| Porosity                                               | %             | 33        |
| <b>Mechanical properties at RT</b>                     |               |           |
| MOR 20°C                                               | MPa           | 5         |
| Impregnated MOR                                        | MPa           | 20        |
| <b>General properties</b>                              |               |           |
| Cristobalite<br>Content<br>As fired :<br>After 1530°C: | %             | >8<br>>60 |
| Roughness (Ra)                                         | µm            | 3         |
| Thermal expansion<br>Thermal expansion                 | 20-<br>1000°C | <0.2%     |
|                                                        | 20-<br>1525°C | <0.4%     |
| Non contractual data for reference only - V24102019    |               |           |

# ALUMINIUM NITRIDE

## ✓ Properties

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

## ✓ Application

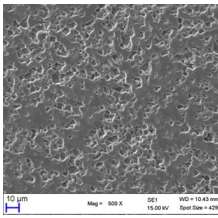
- ✓ Electronics industry



Available on C900 FLEX



# ALUMINIUM NITRIDE

|                                                     |                                                                                      | Values                            |       |
|-----------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------|-------|
| Microstructure                                      |                                                                                      |                                   |       |
| Densification rate                                  | %                                                                                    | 97                                |       |
| Density                                             | g/cm <sup>3</sup>                                                                    | 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 <sup>-6</sup> .K <sup>-1</sup> | 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)

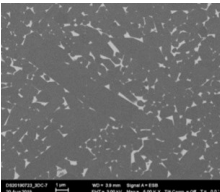
## ✔ Application

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



Available on C100 EASY,  
C1000 FLEXMATIC & C900  
FLEX

# SILICON NITRIDE

|                                                     |          |                                                                                      | Values |
|-----------------------------------------------------|----------|--------------------------------------------------------------------------------------|--------|
| Microstructure                                      |          |                                                                                      |        |
| Densification rate                                  |          | %                                                                                    | >97    |
| Open porosity                                       |          | %                                                                                    | <2.5   |
| Density                                             |          | g/cm <sup>3</sup>                                                                    | > 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 <sup>-6</sup> .K <sup>-1</sup>                                                    | 0.67   |
|                                                     | at 20°C  |                                                                                      | 1.23   |
|                                                     | at 60°C  |                                                                                      | 1.52   |
| Non contractual data for reference only - V24102019 |          |                                                                                      |        |

# SILICORE

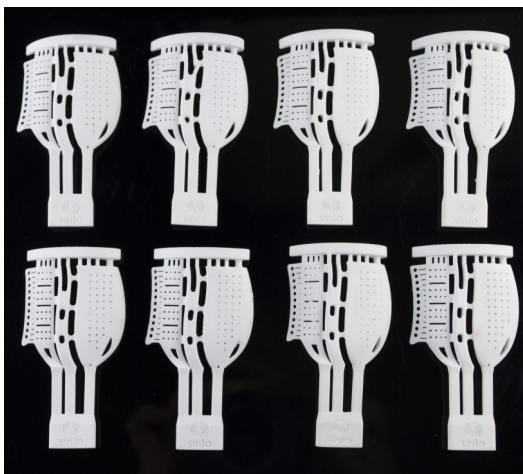
Silica based ceramic, our mix for foundry cores.

## ✔ 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

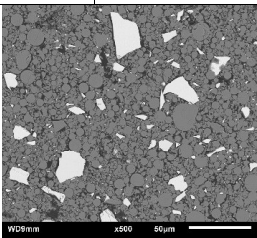
## ✔ Application

- ✔ Foundry cores



Available on C100 EASY,  
C1000 FLEXMATIC & C900  
FLEX

# SILICORE

|                                                               |                                                                                     | Values |
|---------------------------------------------------------------|-------------------------------------------------------------------------------------|--------|
| <b>Microstructure</b>                                         |                                                                                     |        |
| <i>Porosity can be adjusted according to customer's needs</i> |                                                                                     |        |
| Porosity                                                      | %                                                                                   | 29     |
| Density                                                       | g/cm <sup>3</sup>                                                                   | 1.77   |
| SEM picture                                                   |  |        |
| <b>Mechanical properties at RT</b>                            |                                                                                     |        |
| 3-pt bending strength                                         | MPa                                                                                 | 15.4   |
| <b>General properties</b>                                     |                                                                                     |        |
| 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

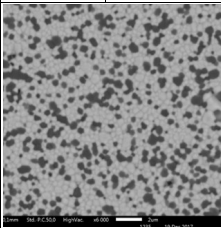
## ✓ Applications

- ✓ Implants
- ✓ Teeth
- ✓ Wear resistant parts



Available on C900 FLEX

# ALUMINA TOUGHENED ZIRCONIA

|                                                     |                                                                                      | Values                            |      |
|-----------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------|------|
| Microstructure                                      |                                                                                      |                                   |      |
| Densification rate                                  | %                                                                                    | >99                               |      |
| Density                                             | g/cm <sup>3</sup>                                                                    | >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 <sup>-6</sup> .K <sup>-1</sup> | 7,50 |
|                                                     | at 20°C                                                                              |                                   | 7,94 |
|                                                     | at 60°C                                                                              |                                   | 8,33 |
| 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

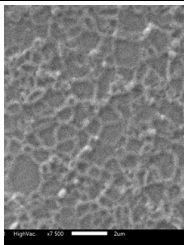
## ✓ Applications

- ✓ Optical parts for aerospace
- ✓ Metrology



Available on C900 FLEX

# CORDIERITE

|                                                     |          | Values                                                                              |       |
|-----------------------------------------------------|----------|-------------------------------------------------------------------------------------|-------|
| Microstructure                                      |          |                                                                                     |       |
| Densification rate                                  |          | %                                                                                   | >98   |
| Density                                             |          | g/cm <sup>3</sup>                                                                   | >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 <sup>-6</sup> .K <sup>-1</sup>                                                   | -0.87 |
|                                                     | at 20°C  |                                                                                     | -0.10 |
|                                                     | at 60°C  |                                                                                     | 0.22  |
| Non contractual data for reference only - V19102018 |          |                                                                                     |       |

# ZIRCONIA 8Y

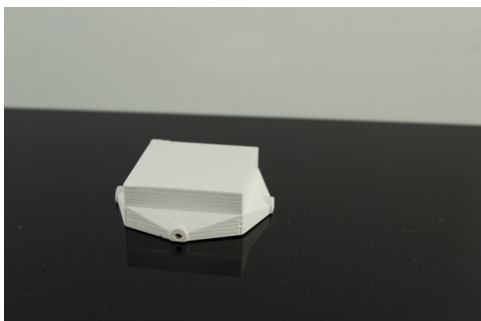
## For non medical use

### ✓ Properties

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

### ✓ Applications

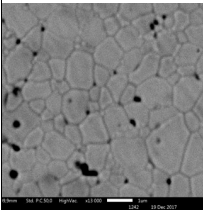
- ✓ Fuel cell



Available on C100 EASY,  
C1000 FLEXMATIC & C900  
FLEX

# ZIRCONIA 8Y

## For non medical use

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

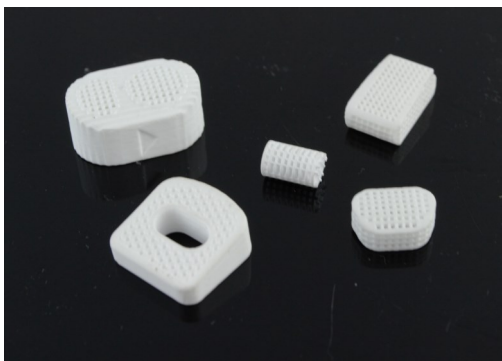
# TRICALCIUM PHOSPHATE

## ✔ Properties

- ✔ Biocompatible
- ✔ Bioresorbable

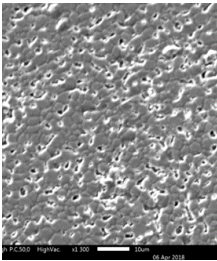
## ✔ Applications

- ✔ Implants



Available on C900 FLEX

# TRICALCIUM PHOSPHATE

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

# FUSED SILICA

## ✓ **Properties**

- ✓ Good leachability

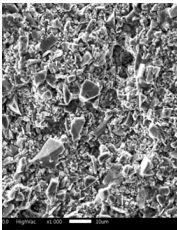
## ✓ **Applications**

- ✓ Foundry cores



Available on C900 FLEX

# FUSED SILICA

|                                                        |                                                                                     | Values |
|--------------------------------------------------------|-------------------------------------------------------------------------------------|--------|
| Microstructure                                         |                                                                                     |        |
| Porosity can be adjusted according to customer's needs |                                                                                     |        |
| Porosity                                               | %                                                                                   | 40     |
| Density                                                | g/cm <sup>3</sup>                                                                   | 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

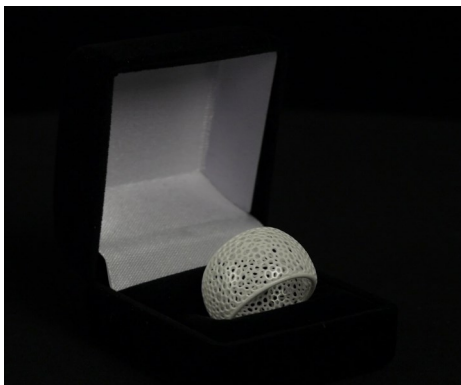
## For non medical use

### ✓ Properties

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

### ✓ Applications

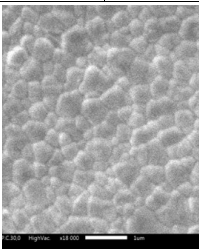
- ✓ Jewelry
- ✓ Watches
- ✓ Biomedical devices
- ✓ Biomedical implants
- ✓ Electronic equipment



Available on C100 EASY,  
C1000 FLEXMATIC & C900  
FLEX

# ZIRCONIA 3Y

## For non medical use

|                                                     |                                                                                     | Values                            |      |
|-----------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------|------|
| Microstructure                                      |                                                                                     |                                   |      |
| Densification rate                                  | %                                                                                   | >99.5                             |      |
| Density                                             | g/cm <sup>3</sup>                                                                   | >5.95                             |      |
| Grain size after sintering                          | µm                                                                                  | 2 to 3                            |      |
| 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 <sup>-6</sup> .K <sup>-1</sup> | 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

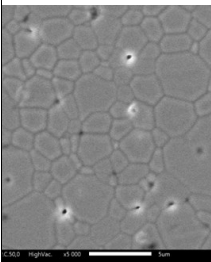
## ✓ Applications

- ✓ Tibial osteotomy wedges
- ✓ Intervetebraal cages
- ✓ Cranial implants
- ✓ Bone substitute
- ✓ Spine implants
- ✓ Orthopedic implants



Available on C100 EASY,  
C1000 FLEXMATIC & C900  
FLEX

# HYDROXYAPATITE

|                                                     |                                                                                      | Values       |
|-----------------------------------------------------|--------------------------------------------------------------------------------------|--------------|
| Microstructure                                      |                                                                                      |              |
| Densification rate                                  | %                                                                                    | >96          |
| Density                                             | g/cm <sup>3</sup>                                                                    | >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 |                                                                                      |              |

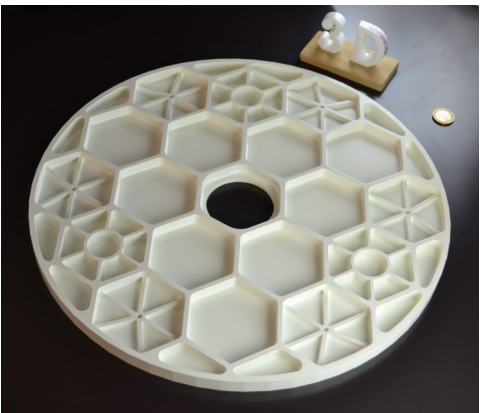
# ALUMINA

## ✓ Properties

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

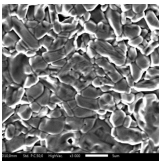
## ✓ Applications

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

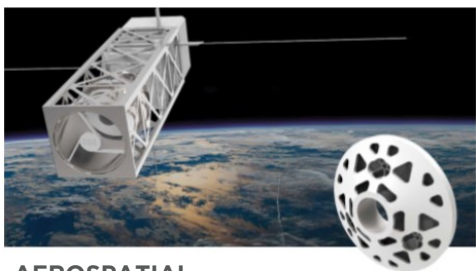


Available on C100 EASY, C900 FLEX, C3600 ULTIMATE & C1000 FLEXMATIC

# ALUMINA

|                                                     |          | Values                                                                              |      |
|-----------------------------------------------------|----------|-------------------------------------------------------------------------------------|------|
| Microstructure                                      |          |                                                                                     |      |
| Density                                             |          | g/cm <sup>3</sup>                                                                   | >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 <sup>1/2</sup>                                                                | 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 <sup>-6</sup> .K <sup>-1</sup>                                                   | 3.74 |
|                                                     | at 20°C  |                                                                                     | 4.98 |
|                                                     | at 60°C  |                                                                                     | 5.51 |
| Non contractual data for reference only - V19102018 |          |                                                                                     |      |

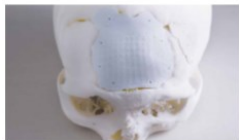
## OUR SERVICES



**AEROSPATIAL**



**FOUNDRY CORES**



**BIOMEDICAL**