

# Saint-Gobain Ceramics Product Offering



## Typical Physical Properties

Saint-Gobain Ceramics offers a broad range of ceramic materials to meet your exact needs for a wide variety of applications. With decades of experience, we can supply these materials as finished components, unfinished, machined blanks, pressed near net shape blanks, high volume pressed net shape components, and complex, highly machined parts.

**Hexoloy® SA Silicon Carbide** – high hardness, compressive strength and light weight

**Hexoloy® SP Silicon Carbide** – improves upon the exceptional friction properties of Hexoloy SA SiC through the addition of spherical pores

**Hexoloy® SE Silicon Carbide** – produced in a proprietary extrusion process with extreme hardness and high strength for severe environment applications.

**Hexoloy® SG Silicon Carbide** – a unique electrically conductive analog of sintered silicon carbide.

**Enhanced Hexoloy® SA Silicon Carbide** – exhibits reduced microporosity which results in increased flexural strength and a higher Weibull modulus.

**AlNimax™ HP Aluminum Nitride** – high purity, fully dense ceramic material featuring excellent plasma resistance

**Norbide® Hot Pressed Boron Carbide** – the third hardest material known to man, lowest density

**Noralide® NBD-200 Hot Pressed Silicon Nitride** – ideal for applications where maximum fracture toughness and flexural strength are required.

See the table inside for typical properties of these materials. Saint-Gobain Ceramics application engineers can assist you with the design of cost-effective high performance components for your specific need.



Hexoloy® SA SiC

# Typical Physical Properties

Physical	Units	Hexoloy® SA	Hexoloy® SP	Hexoloy® SE	Enhanced Hexoloy® SA
Composition*		SSiC	SSiC	SSiC	SSiC
Grain Size	µm	4-10	4-10	4-10	4-10
Density	g/cm <sup>3</sup>	3.1	3.04	3.07	3.1
Hardness (Knoop 0.1 kg load)	kg/mm <sup>2</sup>	2800	2800	2800	2800
Hardness (Vickers 10 kg load)	GPa	–	–	–	–
Flexural Strength 4 pt @ RT**	MPa x 10 <sup>3</sup> lb/in <sup>2</sup>	380 55	240 35	380 55	428 62
Compressive Strength @ RT	MPa x 10 <sup>3</sup> lb/in <sup>2</sup>	3900 560	– –	– –	3900 560
Modulus of Elasticity @RT	GPa x 10 <sup>6</sup> lb/in <sup>2</sup>	410 59	400 58	350 N/A	410 59
Weibull Modulus (2 parameters)	–	8	19	8	12
Poisson Ratio	N/A	0.14	0.14	0.14	0.14
Fracture Toughness @ RT Double Torsion & SENB	MPa x m <sup>1/2</sup> x 10 <sup>3</sup> lb /in <sup>2</sup> /in <sup>1/2</sup>	4.60 4.20	4.3 3.9	4.60 4.20	4.60 4.20
Fracture Toughness @RT Indentation	MPa x m <sup>1/2</sup>	–	–	–	–
Coefficient of Thermal Expansion RT to 700°C	x 10 <sup>-6</sup> mm/mmK x 10 <sup>-6</sup> in/in°F	4.02 2.20	4.2 2.3	4.02 2.20	4.02 2.20
Max. Service Temp (air)	°C °F	1900 3450	1900 3450	1900 3450	1900 3450
Mean Specific Heat @ RT	J/gmK	0.67	0.59	0.67	0.67
Thermal Conductivity @RT	W/m°K Btu/ft h°F	125.6 72.6	110 64	125.6 72.6	125.6 72.6
@100°C	W/m°K Btu/ft h°F	– –	– –	– –	– –
@200°C	W/m°K Btu/ft h°F	102.6 59.3	– –	102.6 59.3	102.6 59.3
@400°C	W/m°K Btu/ft h°F	77.5 44.8	– –	77.5 44.8	77.5 44.8
Permeability @RT to 1000 °C		Impervious to gases over 31 MPa			
Apparent Porosity	%	–	–	0.6	–
Electrical Resistivity @RT**** @1000°C	ohm-cm ohm-cm	10 <sup>2</sup> -10 <sup>8</sup> 0.01-0.2	N/A N/A	10 <sup>2</sup> -10 <sup>8</sup> 0.01-0.2	10 <sup>2</sup> -10 <sup>8</sup> 0.01-0.2
Emissivity	–	0.9	0.9	0.9	0.9
Dielectric Constant (RT, 1 MHz)	–	–	–	–	–
Loss Tangent (RT, 1 MHz)	–	–	–	–	–
Pore Volume Fraction	%	–	4.0-6.0	–	–
Pore Size (Typical)	µm	–	50	–	–

\* Composition code: SSiC = Sintered Silicon Carbide; AlN = Aluminum Nitride; B<sub>4</sub>C = Boron Carbide; Si<sub>3</sub>N<sub>4</sub> = Silicon Nitride

\*\* Test Bar Size: 3 x 4 x 45 mm (0.118" x 0.157" x 1.772")

\*\*\* RT to 1000°C

\*\*\*\* Dependent upon dopants in Hexoloy® SA SiC which will decrease electrical resistivity

N/A = Not Applicable or Not Available

## Typical Physical Properties

Physical	Units	Hexoloy® SG	AlNimax™ HP	Norbide® Hot Pressed	Noralide® NBD-200
Composition*		SSiC	>99.9 AlN	B <sub>4</sub> C	Si <sub>3</sub> N <sub>4</sub>
Grain Size	µm	4-10	3	8	<2
Density	g/cm <sup>3</sup>	3.0	3.26	2.50	3.18
Hardness (Knoop 0.1 kg load)	kg/mm <sup>2</sup>	2800	N/A	2800	N/A
Hardness (Vickers 10 kg load)	GPa	–	–	–	16
Flexural Strength 4 pt @ RT**	MPa x 10 <sup>3</sup> lb/in <sup>2</sup>	311 N/A	340 N/A	425 N/A	806 N/A
Compressive Strength @ RT	MPa x 10 <sup>3</sup> lb/in <sup>2</sup>	– –	– –	2900 420	3500 –
Modulus of Elasticity @RT	GPa x 10 <sup>6</sup> lb/in <sup>2</sup>	N/A N/A	N/A N/A	440 N/A	320 N/A
Weibull Modulus (2 parameters)	–	18	N/A	N/A	N/A
Poisson Ratio	N/A	0.17	N/A	0.18	N/A
Fracture Toughness @ RT Double Torsion & SENB	MPa x m <sup>1/2</sup> x 10 <sup>3</sup> lb /in <sup>2</sup> /in <sup>1/2</sup>	3.9 N/A	2.6 N/A	3.1 N/A	N/A N/A
Fracture Toughness @RT Indentation	MPa x m <sup>1/2</sup>	–	–	–	4.1
Coefficient of Thermal Expansion RT to 700°C	x 10 <sup>-6</sup> mm/mmK x 10 <sup>-6</sup> in/in°F	4.6 N/A	5 N/A	5 N/A	2.9*** N/A
Max. Service Temp (air)	°C °F	1900 3450	N/A N/A	600 1112	N/A N/A
Mean Specific Heat @ RT	J/gmK	0.65	N/A	N/A	N/A
Thermal Conductivity @RT	W/m°K Btu/ft h°F	118 –	80 N/A	90 N/A	N/A N/A
@100°C	W/m°K Btu/ft h°F	– –	– –	– –	29 –
@200°C	W/m°K Btu/ft h°F	92 –	– –	– –	– –
@400°C	W/m°K Btu/ft h°F	70 –	– –	– –	– –
Permeability @RT to 1000 °C		Not impervious	Impervious to gases over 31 MPa		
Apparent Porosity	%	–	–	–	–
Electrical Resistivity @RT**** @1000°C	ohm-cm ohm-cm	1.0 N/A	>10 <sup>13</sup> N/A	0.3 N/A	>10 <sup>12</sup> N/A
Emissivity	–	0.9	0.9	N/A	N/A
Dielectric Constant (RT, 1 MHz)	–	–	9	–	–
Loss Tangent (RT, 1 MHz)	–	–	<10 <sup>-3</sup>	–	–
Pore Volume Fraction	%	–	–	–	–
Pore Size (Typical)	µm	–	–	–	–

\* Composition code: SSiC = Sintered Silicon Carbide; AlN = Aluminum Nitride; B<sub>4</sub>C = Boron Carbide; Si<sub>3</sub>N<sub>4</sub> = Silicon Nitride

\*\* Test Bar Size: 3 x 4 x 45 mm (0.118" x 0.157" x 1.772")

\*\*\* RT to 1000°C

\*\*\*\* Dependent upon dopants in Hexoloy® SA SiC which will decrease electrical resistivity

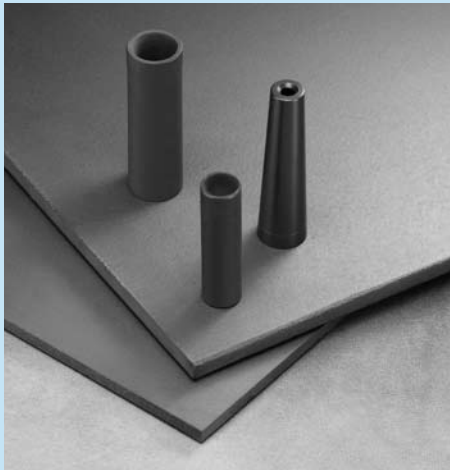
N/A = Not Applicable or Not Available



Typical sealface and bearing components currently fabricated in Hexoloy® SP SiC



Ceramic Tile Components



Norbide® Hot Pressed Boron Carbide



Hexoloy® SE SiC Beams



Noralide® NBD-200 Hot Pressed  
Silicon Nitride

Saint-Gobain Ceramics  
Structural Ceramics  
Hexoloy® Products  
23 Acheson Drive  
Niagara Falls, NY 14303  
Tel: 716-278-6233  
Fax: 716-278-2373  
e-mail: [scd.sales@saint-gobain.com](mailto:scd.sales@saint-gobain.com)  
[www.carbo.com](http://www.carbo.com)

Hexoloy®, Norbide® and Noralide® are  
registered trademarks and AlNimax™ is  
a trademark of Saint-Gobain Ceramics

©2005 Saint-Gobain Ceramics  
All Rights Reserved  
Form No. B-1056  
2/05

### A world leader in ceramic materials.

Saint-Gobain Ceramics offers vast resources to meet your needs for structural ceramic products. With global representation and manufacturing locations in North America, Europe, Australia and South America, we can deliver your solution when you need it, where you need it, in virtually every corner of the world.

You can count on Saint-Gobain's expertise to help you specify the correct structural ceramic materials to meet exacting component design criteria. Our applications engineering support team has the experience and talent to provide solutions to product design problems. Our proven manufacturing capabilities ensure world-class supply and quality assurance.

Visit [www.carbo.com](http://www.carbo.com) for more information.

The information recommendations, and opinions set forth herein are offered solely for your consideration, inquiry and verification and are not, in part or total, to be construed as constituting a warranty or representation for which we assume legal responsibility. Nothing contained herein is to be interpreted as authorization to practice a patented invention without a license.