Machinable Aluminum Nitride Ceramic
SHAPAL™-M soft

Ceramic materials are distinguished from metals and polymers by their unique characteristics. Unfortunately, two of these characteristics, brittleness and hardness, make them difficult to machine and this can limit their applications.

Grades of ceramic have been developed which can be machined but they are not suitable for all engineering applications due to their low flexural strength. *SHAPAL™-M soft* was developed by Tokuyama Corporation to specifically address these issues and is a machinable ceramic which offers both high mechanical strength and thermal conductivity.

SHAPAL™-M soft is based upon the first translucent aluminum nitride developed by Tokuyama Soda Co. Ltd. and is a composite sintered body of AlN and BN. This material has unique characteristics which make it suitable for a wide range of applications. Goodfellow is now able to offer *SHAPAL™-M soft* as rods, sheets and finished components through The Technical Glass Company, an international supplier of specialist glass and ceramics and a member of the Goodfellow Group of Companies.

Characteristics of *SHAPAL™-M soft*

> Excellent Machinability
High precision, close tolerance components can be machined from *SHAPAL™-M soft* using a wide range of techniques including drilling, grinding, turning and milling.

> High Thermal Conductivity
The thermal conductivity of *SHAPAL™-M soft* is approximately 5x that of alumina.

> High Mechanical Strength
SHAPAL™-M soft has a flexural strength of 30kg/mm^2, which is comparable to that of alumina.

In addition to the above mechanical properties, *SHAPAL™-M soft* offers the following:

> Excellent electrical insulation
> Low thermal expansion
> Low dielectric loss
> Excellent high temperature properties
> Suitability for vacuum applications

Photo courtesy of Tokuyama Corporation

SHAPAL™-M *is a trademark of Tokuyama Corporation*

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Manufacturing Applications of *SHAPAL™-M soft*

> Prototyping and/or small volume production

> Vacuum components

> Electrical components (where electrical insulation and heat dissipation are required)

> Jigs/Fixtures (where a low coefficient of thermal expansion is required)

> Electrical components (where low dielectric constant and heat dissipation are required)

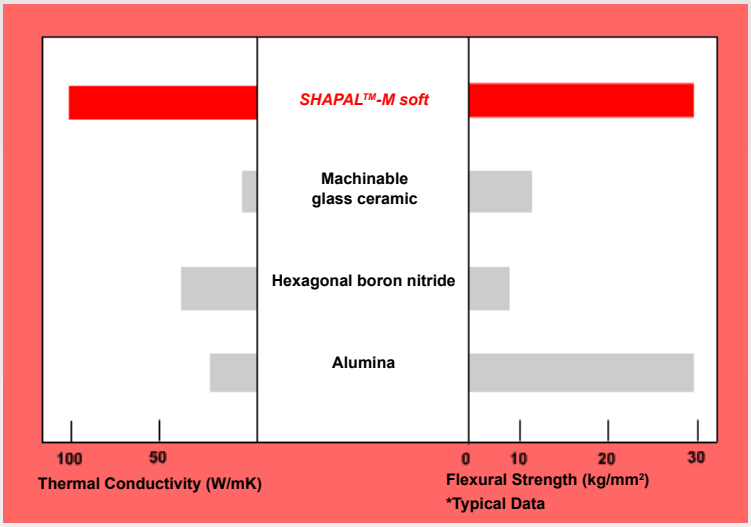
> Heat sinks

> Crucibles for vacuum applications

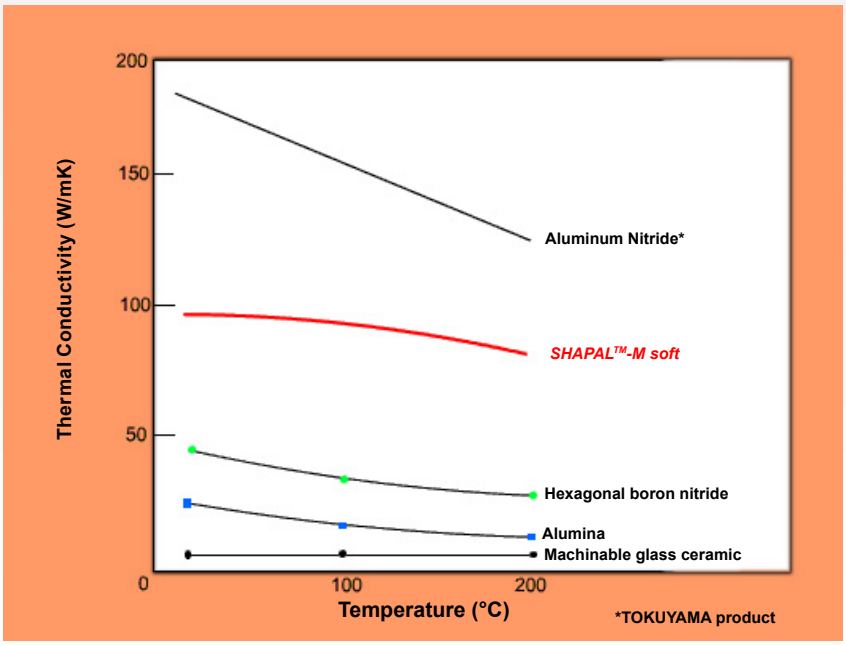
> Special refractory parts

> Wide range of industrial and structural products

Comparison of flexural strengths and thermal conductivities of ceramics*



Thermal conductivity vs. Temperature



Impurities

Ca	450ppm
Cr	60ppm
Mg	15ppm
Ni	< 5ppm
Fe	20ppm
Si	< 15ppm
O	0.5%

Impurities are kept at very low levels by careful raw material selection and strict manufacturing conditions.

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Characteristics

Property	Test Conditions	SHAPAL™-M soft	Units
GENERAL			
Density	Corrected to 4°C	2.90	g/cm^3
Porosity	25°C	0	%
ELECTRICAL			
Volume Resistivity	25°C, DC	10^{12}	Ω cm
Dissipation Factor (tan δ)	25°C, 1 MHz	0.001	
Dielectric Constant (ε)	25°C, 1 MHz	7.1	
Dielectric Strength	25°C, Sample thickness 1mm, AC	40	kV/mm
THERMAL			
Thermal Expansion Coefficient	RT to 400°C	4.4×10^{-6}	/°C
	RT to 600°C	4.8×10^{-6}	/°C
	RT to 800°C	5.1×10^{-6}	/°C
Thermal Conductivity	25°C	90	W/mK
Maximum Use Temperature	in air	1000	°C
	in nonoxidizing atmosphere	1900	°C
Thermal Shock Resistance (ΔT)	water quench	400	°C
MECHANICAL			
Flexural Strength	25°C	30	kg/mm^2
Compressive Strength	25°C	120	kg/mm^2
Modulus of Elasticity	25°C	1.9×10^4	kg/mm^2
Poisson's Ratio	25°C	0.31	
Vickers Hardness (Hv)	25°C, 300g	390	kg/mm^2
CHEMICAL DURABILITY			
Resistance to Acid	10% HCl (24hrs, 25°C)	0.2	mg/cm^2 (wt. loss)
Resistance to Alkali	10% NaOH (24hrs, 25°C)	60	mg/cm^2 (wt. loss)

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