

## About Alumina



Alumina, also known as Aluminum Oxide, is a hard wearing advanced technical ceramic material frequently used in a wide variety of industrial applications. Once fired and sintered, it can only be machined using diamond-grinding methods. It features high hardness and wear resistance, low erosion levels, high temperature resistance, corrosion resistance, and bioinertness. Additionally, it can be highly polished making it useful for precision sealing applications like pumps and pistons.

Alumina is an excellent high temperature ceramic material due to its high temperature stability. It is the most commonly used type of advanced ceramic and VHANDY's alumina ceramics is available in purities ranging from 95 – 99.9%. Precision Ceramics has access to many different types of Alumina including: injection molded, dry pressed, isostatically pressed, slip cast, and extruded.

## Alumina Properties

**High Temperature Ability** – Alumina can be used in both oxidizing and reducing atmospheres up to 1650°C (2900°F) and in vacuum environments up to 2000°C (3600°F).

**Abrasion Resistant** – Alumina is a very hard ceramic and is excellent at resisting abrasion. It is ideal for wear-resistant inserts or products.

**Electrical Insulator** – Alumina is commonly used as a high temperature electrical insulator, particularly the higher purity grades which offer better resistivity.

**Chemical Resistance** – Alumina offers good resistance to strong acids and alkalis at elevated temperatures and is ideal for applications where resistance to corrosive substances is required.

- High hardness
- Wear & abrasion resistant
- High compressive strength
- High mechanical Strength
- Resists strong acid and alkali attack at high temperatures
- Excellent electrical insulation properties
- Decent thermal conductivity

## Alumina Applications

- Wire and thread guides
- Mechanical seals
- Seal faces
- Valve seats
- Machine components
- High temperature electrical insulators
- High voltage insulators
- Electronic components & substrates
- Ballistic Armor
- Roller & Ball Bearings
- Wear resistant linings
- Semiconductor parts
- Laser cavities
- Tap plates
- Shot blast nozzles
- Knife Sharpeners
- Precision shafts and axles in high wear environments

Item	Unit	99.7% Al <sub>2</sub> O <sub>3</sub>
Purity	%	99.7
Density	g/cm <sup>3</sup>	3.9
Porosity	%	0
Firing Temp	°C	1800
Hardness	HV	1700
Flexural Strength	Kgf/cm <sup>2</sup>	3500
Compressive Strength	Kgf/cm <sup>2</sup>	30000
Fracture Toughness	MPa/m	4
Max Operating Temp	°C	1700
Coefficient	cm/cm/°C	8
Thermal Expansion	(RT to 700°C)	
Thermal Conductivity	W/m°K	27
Volume Resistivity	20°C	10 <sup>12</sup>
	100°C	10 <sup>13</sup>
	300°C	10 <sup>12</sup> ~10 <sup>13</sup>
(ohm – cm)	10 <sup>10</sup>	10 <sup>12</sup>
Dielectric Strength	Volts/mil	220

## Alumina Machining & Grinding

Alumina can be machined in green, biscuit, or fully dense states. While in the green or biscuit form it can be machined relatively easily into complex geometries. However, the sintering process that is required to fully densify the material causes the alumina body to shrink approximately 20%. This shrinkage means that it is impossible to hold very tight tolerances when machining alumina pre-sintering. In order to achieve very tight tolerances, fully sintered material must be machined/ground with diamond tools. In this process a very precise diamond coated tool/wheel is used to abrade away the material until the desired form is created. Due to the inherent toughness and hardness of the material, this can be a time consuming and costly process.