



High Temperature Ceramic Adhesives 1560°F / 850°C to 3200°F / 1760°C

These are unique high temperature inorganic ceramic adhesive formulations for bonding and sealing ceramics, metals, quartz, graphite, carbons, textiles and composite materials and structures. High thermal and electrical resistance.

High Temperature Ceramic Adhesives					
Part Number	Filler	Feature	Bonding	Use	Price per Pint*
UCA-1509-1	Alumina	High Fired Strength	C-C	Dense Ceramics	\$ 184.21
UCA-1656-1	Alumina	Adhesion to Metal	C-C; C-M	Low CTE Metals, SOFC's	\$ 184.21
UCA-1707-1	Alumina	Set at Room Temperature. Good Filler	C-C; C-M	Probes, Sensors	\$ 184.21
UCA-1800-1	Alumina	Ceramic Fiber Reinforced	C-C	Refractory Repair	\$ 184.21
UCA-2013-1	Alumina	High Adhesion	C-C; C-M; M-M	Textiles, Threadlocking	\$ 184.21
UCA-2505-1	Alumina	High Strength. Good filler	C-C; C-M	Halogen Lamps	\$ 184.21
UCA-2505 MB-2	Alumina	High Strength. Good filler	C-C; C-M	Halogen Lamps	\$ 184.21
UCA-2439-1	Alumina	Fiber reinforced sealer	C-C; C-M	Tundish Nozzles	\$ 184.21
UCA-2595-1	Aluminum Nitride	High Thermal Conductivity	C-C; C-M	Probes, Sensors	\$ 269.87
UCA-2004-1	Alumina-Silica	Set at Room Temperature. Good Filler	C-C; C-Met	Oxygen Sensors	\$ 184.21
UCA-2031-1	Alumina-Silica	Set at Room Temperature. Good Filler	C-C; C-Met	Induction Coils	\$ 184.21
UCA-2070-1	Boron Nitride	Good Fired Strength	C-C	Boron Nitride	\$ 184.21
UCA-1653RN-1	Graphite	High Adhesive Strength	Graphite, Carbon	Structures, Molds	\$ 219.68
UCA-2007-1	Graphite	Ceramic Fiber Reinforced	Graphite, Carbon	Structures, Molds	\$ 184.21
UCA-1713-2	Magnesium Oxide	Dielectric, High Strength	C-M; M-M	Heaters, Sensors	\$ 184.21
UCA-1854-1	Silica	Low CTE, Good Strength	C-C; Quartz	Tubes, Vessels, Sensors	\$ 184.21
UCA-1548-1	Zirconia	Dielectric, Moisture Resistant	C-C; C-M; M-M	Thermocouples	\$ 184.21
UCA-2055-1	Zirconia	Bonds Plated Metals to Ceramic	C-M	Heaters, Ignitors, Gasketing	\$ 184.21
UCA-2505-1	Zirconia	Fiber reinforced, sets room temperature	C-C; C-M	Halogen Lamps	\$ 184.21
UCA-2655-1	Zirconia	Bonds and coats Zirconia, High Strength	C-C	Zirconia, SOFC's	\$ 184.21
UCA-2670-1	Silicon Carbide	Bonds SiC and Graphite Components	C-C, Graphite	High Vacuum Fixtures	\$ 184.21

Bonding: C-C is Ceramic-to-Ceramic; C-M is Ceramic-to-Metal; M-M is Metal-to-Metal. Last digit in the part number indicates number of components: 1 is a one part adhesive; 2 is a two part adhesive. Most 1 part adhesives are delivered with a six month shelf life.

* Other sizes generally available are Quart, Gallon and 5 Gallon. For Quart size, price is 1.8 x Pint price. For Gallon size, price is 3.3 x Pint price. Some items incur higher shipping charges in sizes of 1 gallon and above due to classification as hazardous (Not classified as hazardous in smaller sizes).

Easy to use one and two component systems. Most are air dry at ambient temperature for 1-2 hours, followed by a 200°F to 700°F cure.

Please Note: These products are custom produced to order in small batches and all sales are final.

HIGH TEMPERATURE CERAMIC ADHESIVE & PASTE PROPERTIES

Product No.	1509	1656	1707	1800	2013	2439	2505M ⁽⁶⁾	2004	2031	2595	2070	1653RN ⁽¹⁾	2007	1713	1854	2670	1548	2055	2505	2655
Trade Name	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax	CerMax
Major Constituent	Alumina																			
Maximum Temperature °F (°C)	3000 (1650)	3000 (1650)	3000 (1650)	2500 (1371)	3200 (1760)	3000 (1650)	3000 (1650)	2500 (1371)	2400 (1316)	3000 (1650)	1560 (850) 2700 (1482)	5400 (2985)	2500	3200 (1760)	3000 (1650)	2500 (1371)	3200 (1760)	2500 (1371)	3000 (1650)	3200 (1760)
CTE, in/in/°F x 10 ⁻⁶ (°C)	4.0 (7.2)	4.3 (7.7)	4.2 (7.6)	4.2 (7.6)	4.1 (7.4)	4.0 (7.2)	4.0 (7.2)	4.0 (7.2)	4.1 (7.4)	1.5 (2.7)	2.0 (3.6)	4.1 (7.4)	4.2 (7.6)	7.0 (12.6)	33 (59)	2.4 (4.4)	4.1 (7.4)	4.5 (8.1)	4.0 (7.2)	4.0 (7.2)
Volume Resistivity, ohm-cm @ RT (@ 1000 °F)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	10 ¹⁵ (10 ¹⁵)	10 ¹⁵ (10 ¹⁵)	NA (NA)	NA (NA)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	NA	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)	10 ⁸ (10 ⁸)
Dielectric Strength, volts per mil @ RT (@ 1000 °F)	253 (240)	250 (80)	256 (100)	200 (80)	250 (97)	250 (80)	245 (95)	245 (95)	200 (100)	500 (300)	500 (300)	NA (NA)	NA (NA)	255 (100)	200 (180)	NA	250 (80)	200 (150)	200 (100)	250 (80)
Torque Strength, ft-lbs ⁽²⁾	5.6	6.7	6.0	8.3	24.0	18.5	8.5	10.6	6.3	8.3	NA	9.5	2.1	21.6	5.2	10.5	8.6	9.0	7.5	8.0
Moisture Resistance ⁽⁵⁾	Good	Excellent	Excellent	Good	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Good	Good	Excellent	Good	Good
Alkali Resistance ⁽⁵⁾	Fair	Good	Good	Good	Excellent	Excellent	Excellent	Excellent	Good	Good	Good	Good	Good	Good	Good	Good	Excellent	Good	Good	Good
Acid Resistance ⁽⁵⁾	Excellent	Good	Excellent	Fair	Good	Good	Good	Good	Good	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good	Good
No. Components ⁽¹⁾	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1
Mix Ratio, powder:liquid	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.5:1	N/A	N/A	N/A	N/A	N/A	N/A
Viscosity, cP	43,000	62,000	Paste	Paste	84,000	Paste	35,000	Paste	43,000	62,000	Paste	Paste	Paste	60,000	34,000	49,000	83,000	75,000	Paste	Paste
Specific Gravity, gms/cc	2.50	2.07	2.30	2.16	2.24	2.18	2.41	2.09	2.17	2.01	1.40	1.56	1.58	1.50	1.60	2.18	2.24	1.85	2.41	2.99
Air Set, hours	<1	1-4	1-4	2-4	1-4	4	2	1	1-4	1-4	1-4	1-4	1-4	1-4	1-4	<1	1-4	2-3	<1	<1
Heat Cure, °F, hrs	200, 2 500, 2 700, 2	200, 2 500, 2	200, 2	200, 3	200, 2	200, 3 or 24/RT	200, 2	200, 1-5	200, 2	200, 2	200, 2 500, 2 700, 2	265, 4 500, 2	200, 2	200, 2	200, 2 500, 2 700, 2	200, 2 500, 2 700, 2	200, 2 500, 2 700, 2	200, 2 500, 2	200, 2	200, 2 500, 2
Color	White	White	White	White	White	White	White	White	Off White	Gray	White	Black	Black	Beige	Light Gray	Gray	Tan	Tan	Tan	Tan
Shelf Life, Months	6	6	6	6	6	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Storage, °F	40-90	40-90	40-90	40-90	40-90	40-90	40-90	40-90	40-90	40-90	40-90	40	40-90	40-90	40-90	40-90	40-90	40-90	40-90	40-90

CERAMIC ADHESIVE SELECTOR CHART																							
	MATERIAL	CTE X 10 ⁻⁶ in/in/ °F (°C)	1509	1548	1653RN	1656	1707	1713	1800	1854	2004	2007	2013	2031	2055	2070	2439	2505	2505M	2595	2655	2670	
CERAMICS	ALUMINA (96%)	4.4 (7.9)	•	X		X	X	X	•		•				X		•		•				
	ALUMINUM NITRIDE	1.5 (2.7)						•		X	X					X	•	X	X	•			
	BERYLLIA (95%)	4.1 (7.4)	•	X		X	X	X									X		X				
	BORON CARBIDE	2.6 (4.6)					•			X	•												
	BORON NITRIDE	4.2 (3.8)	•			X										•	X		X				
	CERAMIC TEXTILES	—	•											•		X							
	CORDIERITE	1.1 (1.9)									•					X	X	X					
	GLASS (Borosilicate)	1.8 (3.2)	•								•					X	•		•				
	GLASS BONDED MICA	5.8 (10.4)							X							X		X	X	X			
	GRAPHITE	4.3 (7.7)	X	X	•								•										X
	MACOR®	5.2 (9.4)					X	X				X				X		X	X	X			
	MULLITE	3.0 (5.4)	•				X									X							
	QUARTZ	0.3 (.56)	X				X				•						X		•				
	SAPPHIRE	4.2 (7.6)	•							•		X		•									
	SILICON CARBIDE	2.9 (5.2)	•														X				X	•	
	SILICON NITRIDE	1.8 (3.2)									X						X				X		
	STEATITE	4.0 (7.2)	•	X		X	X									X		X	X	X			
	ZIRCONIA			•												•			•			•	
ZIRCONIA SILICATE			•												•			•			•		
REFRACTORIES	—						•		•		•		•				•	•	X				
METALS	ALUMINUM	15.0 (27.0)						•							X			X					
	BRASS	10.2 (18.4)						•						•	X			X					
	CAST IRON	5.9 (10.6)		X		X	X	•							X								
	COPPER	9.3 (16.7)						•															
	INCONEL	6.4 (11.5)		X		X	•	X															
	MOLYBDENUM	2.9 (5.2)		X		X	•			X											X		
	NICKEL	7.2 (12.9)		X		X	X	•			X					X		X	X				
	NICKEL-IRON	2.6 (4.7)		X		•	X	X			X						X		X				
	PLATINUM	4.9 (8.8)	X														X						
	SILICON	1.6 (2.9)	X	•		X	X										X						
	SILVER	10.6 (19.1)						•															
	S/S (300 SERIES)	9.6 (17.3)		X		X	X	•			X					X		X					
	S/S (400 SERIES)	6.2 (16.6)						•								X							
	STEEL (1010)	6.5 (11.7)		X		X	X	•			X			X		X		X	X	X			
	TANTALUM	3.9 (7.0)	X	X		X	•	X			•	X					X						
TITANIUM	5.8 (10.4)					X	•				X												
TUNGSTEN	2.5 (4.5)		X		X	•				X	X					X	X			X			

• Preferred Product For This Application
 X Applicable Product For This Application

UCA High Temperature Ceramic Adhesives

Design Guidelines

General design criteria for bonding with ceramic adhesives are similar to those for epoxies and other organic adhesives. Main considerations include the coefficient of thermal expansion, joint design, glue line thickness, operating environment, and an understanding of the suitability of ceramic adhesives.

Coefficient of Thermal Expansion

Due to the thermal shock implicit in most ceramic adhesives applications, the joint design should account for the difference in the coefficient of thermal expansion between the adhesive and the components that are being joined. In the illustration above, note that the "poor" design loads the ceramic adhesive in tension, since the metal expands faster than the ceramic. The "good" design allows for this thermal mismatch and loads the adhesive in compression, offering higher reliability.

Glue Line Thickness

The clearance between mating parts at operating temperature should be 2-8 mils (50–200 microns). Less than 2 mils will prevent uniform adhesion, and greater than 8 mils will often result in cohesive shear failure within the adhesive.

Operating Environment

Ceramic adhesives offer excellent electrical, thermal and chemical resistance. In addition, ceramic adhesives, in contrast to organic based materials, will not outgas under high vacuum. All operating conditions such as temperature, thermal cycling, humidity, corrosion and electrical requirements should be considered before selecting a ceramic adhesive.

Joint Design

Since ceramic adhesives exhibit relatively poor tensile and shear strength, it is desirable to design a joint that will distribute the mechanical stress. A glue line with greater surface area, such as a tongue-and-groove joint, should be used to reduce joint stress and increase mechanical strength.

Ceramic Adhesive Limitations

Ceramic adhesives are somewhat brittle and may be affected by dynamic conditions such as vibration and mechanical shock. Expansion joints can be used to relieve stress. Adding ceramic cloth at the interface is also useful.

High Vacuum Applications

Ceramic adhesives can be used under high vacuum conditions without outgassing. However, vacuum seals are difficult to produce unless the adhesive joint is sealed with a glass or glasslike coating. Refer to Technical Bulletin ABTG-A5 for glass sealants; refer to Technical Bulletin ABTG-A11 for high temperature inorganic binders.

Application Procedures

Follow the guidelines below for applying high temperature adhesives. Make sure to read specific application instructions on container before use.

Surface Preparation

Clean surfaces thoroughly prior to application. Extremely smooth surfaces are difficult to bond and should be roughened whenever possible. Porous substrates tend to absorb the adhesive binders and should be pre-coated with an adhesive thinner. Product thinners are designated by adding a "-T" to the part number (eg. 1509-T).

Mixing

High temperature adhesives tend to settle in the container and should be mixed thoroughly and slowly to avoid air entrapment. Reduce viscosity as desired using the appropriate product thinner by up to 15% by weight. Two-component systems should be mixed according to the label instructions.

Application

Apply adhesive to each surface in a thin coat using a brush, spatula or dispenser. Wet the surface thoroughly to ensure good adhesion. Maintain a uniform glue line thickness of 2-8 mils. Apply even pressure (clamp if possible), and wipe away excess material before drying. A graded adhesive joint is recommended when bonding components which have a gross difference in coefficient of thermal expansion (CTE). First coat each substrate with the adhesive that best matches its CTE, then use a third adhesive with an intermediate CTE to bond the parts together.

Example: Bond nickel to silica by pre-coating the nickel with 1713 and the silica with 1854.

Allow each substrate to air dry and cure at 200 °F for 1-2 hours. Apply 1656 as an intermediate adhesive and follow standard instructions in the Curing section. When it is necessary to use an adhesive alternatively as a coating, and several applications are required, allow the substrate to air dry for 1-2 hours before applying a second coat. A 200 °F cure for 1-2 hours is recommended for each successive coat to avoid blistering.

Curing

In general all products should be air set for 1-4 hours, then heat cured at 200 °F (93 °C) for 1-4 hours minimum. 1509, 1548, 1854, 2070, 2655, and 2670 will not dry at room temperature and should be step cured at 200 °F (93 °C), 500 °F (260 °C), and 700 °F (372 °C) for 1-2 hours at each temperature. 1653-RN must be cured at 265° F (130 °C) for 4 hours and 500 °F (260°C) for 2 hours to develop maximum strength. Blistering may occur if the glue line is too thick or heating too rapid. Refer to specific product labels for detailed instructions.

Safety

Read Material Safety Data Sheet carefully before use. All products except 1653 can be washed from the skin with mild soap and warm water. Prolonged skin contact should be avoided to prevent irritation. If any material contacts the eyes, flush continuously with water or neutralizing solutions, then consult a physician immediately.