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

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	2505M⑥	2004	2031	2595	2070	1653RN①	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							Alumina-Silica		Aluminum Nitride④	Boron Nitride	Graphite		Magnesium Oxide	Silica	Silicon Carbide	Zirconia			
	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)③ 2700 (1482)	5400 (2985)	2500	3200 (1760)	3000 (1650)	2500 (1371)	3200 (1760)	2500 (1371)	3000 (1650)	3200
	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)	10^9 (10^5)	10^8 (10^4)	10^9 (10^5)	10^9 (10^5)	10^8 (10^4)	10^9 (10^5)	10^9 (10^5)	10^8 (10^4)	10^9 (10^5)	10^{15} (10^{10})	10^{15} (10^9)	NA (NA)	NA (NA)	10^9 (10^5)	10^9 (10^5)	NA	10^8 (10^4)	10^9 (10^5)	10^9 (10^5)	10^8 (10^4)
	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-lbs②	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 Resistance⑤	Good	Excellent	Excellent	Good	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Good	Good	Excellent	Good	Good
	Alkali Resistance⑤	Fair	Good	Good	Good	Excellent	Excellent	Excellent	Excellent	Good	Good	Good	Good	Good	Good	Good	Good	Excellent	Good	Good	Good
	Acid Resistance⑤	Excellent	Good	Excellent	Fair	Good	Good	Good	Good	Good	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good	Good
Handling	No. Components①	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1
Handling	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
Handling	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
Handling	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
Curing	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
Curing	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, 3	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

QA Certification ISO 9001:2015

Thermal, EMI/RFI & Abrasion Protection Materials

Fax Orders: 610-340-9054 Telephone Orders: 610-906-3549 orders@abthermal.com

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	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 similiar 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.