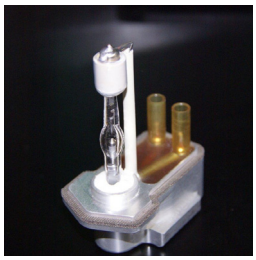
AREMCO

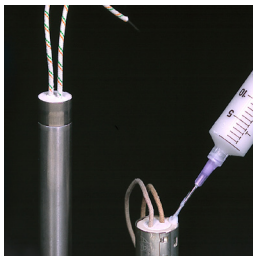
HIGH TEMPERATURE POTTING AND CASTING MATERIALS

Technical Bulletin A4

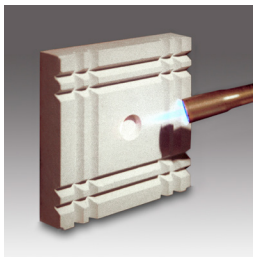
Ceramacast™ 586 pots high power resistor.



Ceramacast™ 575-N bonds Xenon arc lamp.



Ceramacast™ 586 pots ignitor and cartridge heater.



Ceramacast™ 645-N fixture resists propane torch.

Ceramacast™ 673-N bonds SiC combustion nozzle.

Aremco offers the most expansive range of ceramic-based materials used for the assembly of high temperature, high power electrical devices as well as high temperature fixtures, molds and tooling. These materials, based on aluminum oxide, aluminum nitride, magnesium oxide, silicon dioxide, silicon carbide, zirconium oxide, and zirconium silicate, offer unique properties with respect to operating temperature, thermal conductivity, dielectric and mechanical strength.

Ceramacast™ products are supplied in either one-or two-part systems. One-part systems are typically mixed with water or a specialty binder system that is used to improve moisture resistance. Materials set at room temperature in several hours, then cure at ~250 °F in 2–4 hours to provide optimal electrical and mechanical properties. Two-part systems have varying set times and are similiarly cured at 250 °F in 1–2 hours.

TYPICAL APPLICATIONS

Electrical
Ballast Resistors, Cartridge Heaters, Case Resistors, Ceramic Fiber Heaters, Electrical Feed-Thrus, Gas Ignitors, Halogen Lamps, High Temp Air Filters, Infrared Heaters, PTC Devices, Rheostats, Temperature Sensors

Metallurgical
Brazing Fixtures, Crucibles, Encapsulating RF Coils, Furnace Carriers, Heating Element Holders, Induction Heating Tools, Molds for Powder Metallurgy, Rapid Prototype Molds, Sintering Boats, Standoffs, Welding Jigs

SELECTION CRITERIA

- Is the application for potting or casting?
- What is the operating temperature?
- What is the size and geometry of the part?
- Type of materials being used?
- Low or high thermal conductivity required?
- Required electrical properties?
- Mechanical strength required?
- How will the material be dispensed?
- Is the material pot life a consideration?
- Is the cure schedule a consideration?

HIGH TEMPERATURE POTTING AND CASTING MATERIALS PROPERTIES

Product Number	510	575	575-N	576-N	895	675-N	584	645-N	905[3]	673	673-N	646-N	586	900
Trade Name	Ceramacast™													
Major Constituent	Aluminum Oxide					Aluminum Nitride	Magnesium Oxide	Silicon Dioxide		Silicon Carbide		Zirconium Oxide	Zirconium Silicate	
Description	Coarse Grain Castable for Producing Large High-Temp Tooling	Fine Grain Potting Compound for Small Devices	Fine Grain Castable for High Temp Potting and Tooling	Medium Grain Castable for Large High-Temp Potting and Tooling	Fine Grain Castable for High-Temp Tooling, Good Surface Finish	Fine Grain, Thermally Conductive Potting Compound	Two-Part, Ultra Quick-Set Casting and Potting Compound	Low Thermal Conductivity, Low Expansion Potting Compound	Silicone-Silica Moisture Resistant Potting Compound	Two-Part Molding Compound, Good Thermal Conductivity	Adhesive and Potting Compound for Graphite and SiC Components	High Density, High Strength Castable and Potting Compound	High Strength, Dispensable Adhesive and Potting Compound	High Density, High Strength Molding Compound
Temperature Limit, °F (°C)	3200 (1760)	3000 (1650)	3000 (1650)	3000 (1650)	2500 (1371)	2200 (1200)	2800 (1535)	3000 (1650)	900 (482)	2500 (1371)	2500 (1371)	3000 (1650)	2800 (1535)	2800 (1535)
CTE, in/in/°F × 10^{-6} (°C)	3.9 (7.0)	4.3 (7.7)	4.3 (7.7)	4.1 (7.4)	4.0 (7.2)	2.9 (5.2)	6.5 (11.7)	1.5 (2.7)	2.0 (3.8)	3.8 (6.8)	2.9 (5.2)	3.1 (5.6)	2.7 (4.9)	2.8 (4.0)
Volume Resistivity, ohm-cm @ RT	10^9	10^9	10^9	10^9	NA	10^{13}	10^9	10^9	10^9	NA	NA	10^9	10^9	10^9
Dielectric Strength, volts/mil @ RT	75	150	150	150	NA	300	100	300	> 250	NA	NA	250	125	125
Compressive Strength, psi	8,000	7,500	11,800	10,200	8,200	2,000	4,500	7,000	NM	5,000	5,000	11,500	8,000	8,000
Porosity, %	< 7.0	< 6.0	< 2.0	< 2.0	< 6.0	< 3.0	< 6.0	< 5.0	< 1.0	< 9.0	< 4.0	< 2.0	< 2.0	< 5.0
pH	3–4	3–4	2–3	2–3	5–6	2–3	11–12	2–3	NM	5–6	2–3	2–3	2–3	5–6
Moisture Resistance	Good	Good	Good	Good	Good	Good	Good	Good	Excellent	Good	Good	Good	Good	Good
Alkali Resistance	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Acid Resistance[1]	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
No. Components	1 + H_2O	1 + H_2O	1 + H_2O^2	1 + H_2O^2	2	1 + H_2O^2	2	1 + H_2O^2	2	2	1 + H_2O^2	1 + H_2O^2	1 + H_2O^2	2
Mix Ratio, powder:liquid	100 : 15–19	100 : 19–22	100 : 13–15	100 : 12–14	100 : 15–17	100 : 16–18	100 : 25-30	100 : 21–23	100 : 50	100 : 17–20	100 : 13–14	100 : 12–14	100 : 13–15	100 : 15–17
Mixed Viscosity, cP	12,000	16,000	11,000	9,000	22,000	15,000	18,000	10,000	Paste	16,000	12,000	9,000	15,000	25,000
Shrinkage, % at 1000 °F	< 1.0	< 1.0	< 0.3	< 0.3	< 1.0	< 0.3	< 4.0	< 0.3	< 1.0	< 1.0	< 0.3	< 0.3	< 0.3	< 1.0
Pot Life, hrs	2–3	2–3	1–2	1–2	1	1–2	< 10 mins	1–2	NA	< 20 mins	1–2	1–2	1–2	< 20 mins
Shelf Life, months	12	12	12	12	12	12	1	12	905-L:6 905-P:12	12	12	12	12	12
Color	Light Gray	White	White	White	White	Light Gray	Off-White	Off-White	Off-White	Gray	Gray	Tan	Off-White	Off-White
Approximate Powder Density, lbs/gal	15	12	12.5	14.5	12	10.5	12	11	P-9.6/L-4.8	12	14.5	15.5	14	13

Reference Notes

[1] All products are attacked by hydrofluoric acid.

[2] These products can be mixed alternatively with HLB-1 Hydrophobic Liquid Binder to achieve higher moisture resistance.

[3] Ceramacast™ 905 moisture resistance, porosity and shrinkage were tested at 900 °F only.

Abbreviations

NA Not Applicable

NM Not Measured

APPLICATION PROCEDURES

Mixing

Blend powder thoroughly prior to adding water or liquid binder. Use the following mix ratios adding the water or liquid binder into the powder and mixing thoroughly until smooth and uniform Pour the mixture carefully from one side of the part. Vibrate and/or degas as required to help eliminate air bubbles. Agitate continuously or refrigerate to extend the pot life.

Product	Major Constituent	Weight Ratios			
		Powder	Liquid	Min	Max
510	Aluminum Oxide	100	Water	15	19
575	Aluminum Oxide	100	Water	19	22
575-N	Aluminum Oxide	100	Water, HLB-1	13	15
576-N	Aluminum Oxide	100	Water, HLB-1	12	14
895	Aluminum Oxide	100	LB-1	15	17
675-N	Aluminum Nitride	100	Water, HLB-1	16	18
584	Magnesium Oxide	100	584-L	25	30
645-N	Silicon Dioxide	100	Water, HLB-1	21	23
905*	Silicon Dioxide	100	905-L, 905-L1	45	55
673	Silicon Carbide	100	LB-1	17	20
673-N	Silicon Carbide	100	Water, HLB-1	13	14
646-N	Zirconium Oxide	100	Water, HLB-1	12	14
586	Zirconium Silicate	100	Water, HLB-1	13	15
900	Zirconium Silicate	100	LB-1	15	17

*Ceramacast™ 905 is offered in two standard kits. Both kits include the 905-P fused silica powder and one of two binders, 905-L or 905-L1. 905-L is a solution of silicone resin and methyl ethyl ketone that the user supplies. 905-L1 is a silicone resin powder that is mixed in a 1:1 ratio by weight with methyl ethyl ketone to make 905-L at the time of use. The 905-L1 binder is recommended for customers that are concerned about incurring hazardous freight charges associated with shipping methyl ethyl ketone.

*Ceramacast™ 905 will mix to a relatively grainy, non-pourable mixture by design. After mixing and the powder is thoroughly wet-out by the liquid binder, the mixture should be loaded to a filter bag and residual liquid squeezed out of the bag. Afterwards, the mixture should be ladled into the part and cured as recommended.

Curing

Ceramacast™ 510, 575, 673, 895, 900

1. Cover part with a plastic sheet or locate in a humidity chamber for 16–24 hours.
2. Bake at 200 °F for 3 hours.
3. Final cure at 250 °F for 3 hours.

Ceramacast™ 584

1. Material will set in less than 10 minutes. Extend pot life by chilling the liquid to ~50 °F.
2. Air dry for a minimum of 2 hours.
3. Bake at 200 °F for 2 hours.
4. Final cure at 250 °F for 3 hours.

Ceramacast™ 575-N, 576-N, 586, 645-N, 646-N, 673-N, 675-N

1. Air dry for a minimum of 8 hours.
2. Bake at 200 °F for 2–4 hours.
3. Final cure at 250 °F for 3 hours.
4. Final cure at 450 °F for 30–60 minutes when using the HLB-1 Hydrophobic Liquid Binder.

Ceramacast™ 905

1. Air dry for 12–16 hours at room temperature.
2. Bake at 150 °F for 30 minutes.
3. Bake at 250 °F for 30 minutes.
4. Bake at 350 °F for 30 minutes.
5. Final cure at 450 °F for 30 minutes.

Special Notes

1. Chemically absorbed water will remain in all products even after final curing at 250 °F. Based on thermogravimetric studies, it is expected that 100% of chemically absorbed water will be driven off in the 800–1000 °F range. Curing at higher temperatures should be performed to obtain optimal electrical resistance and mechanical strength.
2. Possible causes of cracking include (i) excessive water or liquid binder, (ii) curing is too rapid, or (iii) cross-sectional thickness is too high. Contact Aremco for assistance if cracking persists.
3. Ceramacast™ products tend to react with aluminum molds. Use EZ-Cast™ 580-N Flexible Silicone Rubber Molding Compound to avoid problems when casting ceramic parts.

Safety Precautions

1. Refer to Material Safety Data Sheets before using Aremco's Ceramacast™ or EZ-Cast™ compounds.
2. For Ceramacast™ products, avoid prolonged skin contact to prevent irritation. Wear a dust mask and work in a well-venilated area. If any material enters the eyes, flush with plenty of water and consult a physician.
3. EZ-Cast™ should be handled in a well-ventilated area wearing rubber gloves. Any spillage can be cleaned up using isopropyl alcohol. If any material gets onto the skin, wash with isopropyl alcohol or other solvent, followed by a soap and water rinse. If there is eye contact, flush with water for 10 minutes and consult a physician.

SILICONE MOLDING COMPOUNDS

Aremco's EZ-Cast™ 580N is an ideal compound for producing high reliability master molds. This silicone rubber compound exhibits high tear strength, very low shrinkage and high flexibility, all requirements for detailed reproduction.

PROPERTIES		
Upper Temp. Limit, °F (°C)		400 (204)
Lower Temp. Limit, °F (°C)		−76 (−60)
Flexibility		High
Hardness, Durometer, Shore A		45
Tensible Strength, psi		600 Min
Tear Strength, Die B lb/in		110 Min
Elongation, %		400 Min
Linear Shrinkage, %		< 0.1
Handling	**No. of Components**	2
	Mixed Viscosity, cP	30,000
	Specific Gravity, g/cc	1.3
	Mix Ratio, resin:catalyst	10:1
	Pot Life, mins	30
Shelf Life, @RT, months		6
Color		Beige Resin; Deep Red Catalyst
Weight/Gal		10 lbs resin, 1 lb catalyst

Instructions For Use

1. Machine a master pattern from aluminum and secure master into an aluminum box with removable sides. If a wooden mold is used, make sure that the mold is sealed with wax and that tapers are included to facilitate removal. *Mold should allow for a cast part wall thickness of ⅜" – ½" minimum.*
2. Premix base and activator thoroughly before blending the components together in a ratio of 10 parts base to 1 part activator.
3. Vacuum degas at 29 in Hg. The mixture will rise to about 3–4 times its original volume, then collapse. Hold vacuum for another 1–2 minutes then release.
4. Pour slowly into a master, to fill all details and prevent air entrapment. Cure for 16–24 hours at room temperature, or 3–4 hours at 120 °F, or 1–2 hours at 150 °F. In humid atmosphere, heat cure for best results.

EZ-CAST™ FLEXIBLE MOLDS IN TWO EASY STEPS

Place the machined master, a duplicate of the finished casting, into a pan, and pour the EZ-Cast™ over the master.

Cure the EZ-Cast™ mold and peel out your finished pliable mold.

Refer to Price List for complete order information.