3MG.001
Ceramic Adhesives

COTRONICS CORP
High Temperature Specialty Materials Since 1971

Summary

Final Advanced Materials Sàrl
3 rue de Paris
68350 Didenheim – France
Tel : +33 (0) 3 67 78 78 78

Final Advanced Materials GmbH
Basler Strasse 115
79115 Freiburg – Deutschland
Tel: + 49 (0) 761 47 87 336

www.final-materials.com

Overview

Final Advanced Materials is collaborating with Cotronics to offer highly effective adhesive products. They are manufactured using high purity technical materials to provide reliable bonds even at high temperature.

Areas of application:

- Research and development, electronics, metallurgical, industrial and nuclear applications, etc.

Applications:

- Electronic components and equipment, high frequency equipment, lamps, moulds, vacuum pumps, thermocouples, etc.
- Protection and sealing for porous heating elements.
- Protection of parts subject to corrosion, oxidisation, chemicals, etc.
- Improvement of electrical contacts subject to high temperatures (e.g. Xenon lamps).
- Repair of metal melting crucibles.
- And any application where bonds, vessels, coatings need to withstand high temperatures.

Advantages:

- Excellent stability at high temperature
- Superior dielectric strength
- Excellent mechanical properties
- Thermal shock resistance
- Resistance to molten metals
- Use in harsh environments, both reducing and oxidising
- Resistance to most solvents and chemical products
- Maximum operating temperature up to 1,650 °C.

General Characteristics

Delivery format

- Powdered oxides to be mixed with a binder (water, sol-gel, solvent, etc.);
- Ready-to-use product.

Implementation

These pastes are often used as supplied, after an initial thorough mixing. They can be applied with a spatula, brush or by dipping. To form a thick coating, apply several layers of approximately ½ mm each, curing between each application.

Once applied, these adhesives dry either at room temperature or by applying mild heat (fast cure). They can be used for bonding, coating, the manufacture of moulds and vessels for metallurgical applications.

Possible types of bond

- Ceramic-to-ceramic, ceramic-to-metal, ceramic-to-glass, ceramic-to-plastic, metal-to-metal, metal-to-glass, graphite-to-graphite.

Selection criteria according to the adhesive category

The choice of ceramic adhesive depends on specific and essential criteria:

- Final application (series, prototyping, single application, etc.)
- Temperatures to withstand (minimum, peak, maximum operating)
- Thermal shock resistance:
  - How long does the adhesive take to go from one temperature extreme to another?
  - What is the frequency of this thermal cycle?
  - Is there any quenching (air, water, oil, etc.)?
- Required level of thermal conductivity
- Required level of dielectric strength
- Acceptable level of thermal expansion
- Chemical environment (vapour, liquid, contaminant, etc.)
- Mechanical constraints (compression, vibration, shock, etc.)
- Electrical constraints
- Surrounding environment (humidity, vacuum, etc.)
- Possible application conditions
- Thermal expansion coefficient of elements in contact
- Drying by curing (maximum temperature)

When bonding two natural substrates with different expansion properties, these parameters need to be brought closer together with the ceramic used. In this way, the bond is more resistant to the stresses induced by contraction or elongation.

Adhesion

The characteristics of the bonding surface are key to obtaining the best adhesion. They are defined by the structure of the surface state and by any residual impurities. Generally, the substrate will need to be machined or sanded to obtain a slight roughness and allow the ceramic cements to bond to it.

If necessary, these ceramic adhesives can be diluted with distilled or de-ionised water or a specific binder. The paste obtained then has a viscosity and fluidity perfect for the application. This viscosity may vary considerably depending on the nature of the application or spraying equipment used (pneumatic, plasma), the spraying distance, the spalling of the pasty dispersion, the diameter of the nozzle and the pressure. In no cases should the percentage in weight of the binder used exceed 5 %. The ideal viscosity depends on the adhesion properties of the substrate and can only be achieved by experimentation.

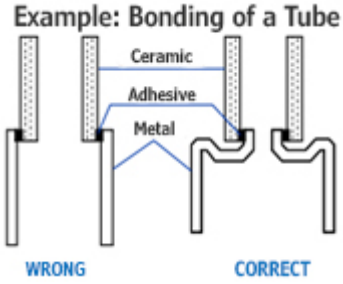
General criteria for defining bonds (ceramics)

The main parameters of ceramic bonding are similar to those of bonding in general:

- **Thickness of the adhesive layer**

At operating temperature, the space between two assembled parts should be approximately 0.3 mm. If a layer is too thin, it prevents even distribution of the adhesive; a layer that is too thick could lead to cohesive failures in the mass of the adhesive.

- **Differential expansion**



At continuous operating temperatures, the nature of the bond must take account of the differences between the expansion coefficients of the materials. The diagram opposite shows the importance of the shape of the bond to avoid separation tension in the adhesive during a metal-to-ceramic bond. On the contrary, an appropriate shape tends to press the adhesive against the ceramic to reinforce the bond.

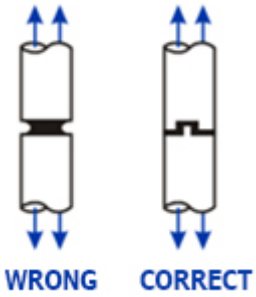
- **External factors**

Epoxy and ceramic adhesives behave well in vacuum as most of them do not outgas. However, electrical, humidity and corrosion factors still need to be taken into account.

- **Intrinsic properties**

Typically fragile, epoxy and ceramic adhesives are affected by vibrations and shocks. Expandable seals or a ceramic covering reduce fatigue. In the case of porous surfaces which absorb the adhesive, an impregnation product should be applied first.

- **Constraints**



The bonding products have relatively low shear and tensile strength. The contact surfaces need to be prepared in order to better distribute these kinds of constraints. In the diagram opposite, the contact line between two parts has been extended for this purpose.

Implementation

All of our adhesives are easy and quick to apply. They can be applied with a brush or spatula, or by impregnation, spraying or dipping.

Advice

- Use clean containers for weighting and mixing.
- Any contamination can affect the properties of the material obtained.
- All proportions are indicated in weight
- Pre-measured kits are available to speed up the tests.
- Shake all of the products in their packaging before use.
- Combine the components after weighing and mix them using a kneading motion for 2 to 3 minutes.
- Scrape the bottom and sides of the container to ensure a uniform, homogeneous product.
- Apply with a trowel or tip into the mould.
- Dry **carefully following the procedure** indicated for the product.

General procedure

1. Surface preparation:
   - **NON-POROUS materials:** Clean the surfaces and remove all traces of old coatings, dust and grease. Dry thoroughly. If possible, sand the surfaces.
   - **POROUS materials:** Remove all dust or residue. Moisten the porous surface with a ceramic thinner.
     - Thinner: 50 % clear water and 50 % ceramic binder/hardener
     - Use the thinner specific to the adhesive.
2. Preparation of the product:
   - Pre-mix adhesive thoroughly prior to use, following the instructions on the label. Be careful not to whip air into the mixture.
3. Implementation:
   - Apply the adhesive using a spatula, brush or by dipping. Completely wet the surfaces.

4. Bonding:
   - Immediately press the surfaces together. If necessary, clamp the pieces to maintain a uniform distance while curing (typically 0.3 mm). Remove excess with a damp cloth.
5. Curing:
   - Faster curing at a higher temperature is possible with many Cotronics adhesives. Consult the label.
   - Ceramic adhesives typically dry at room temperature. This process can be accelerated with the application of mild heat (fast-cure). Lastly, the assembly can undergo heat treatment (post-cure) at high temperature to optimise the adhesive properties.

One-component systems that cure by evaporation
Rescor™ 901, Resbond™ 904, 905, 907, 918, 931C, 989

- Before implementation:
  - Thoroughly mix the ceramic using a glass or stainless-steel rod.
- Implementation:
  - Apply a very thin layer (250 to 500 µm) to the substrate using a scrupulously clean hard brush or a spatula.
- For depositing coatings:
  - Apply successive layers of 250 µm and wait for each layer to cure before applying the next.
- Post-curing:
  - At 370 °C to develop maximum resistance to mechanical stresses, solvents and humidity.
- Can be deposited with a spray for the most fluid versions.

One-component systems with forced curing
Rescor™ 903HP, 931

The colloidal capacity (bond strength) of these products is greater than that of one-components cured by evaporation. Nevertheless, their bonding procedure apart from the following elements:

- Curing the bond after application
  - between 120 °C and 370 °C
- Signs of corrosion may appear after application: these adhesives are slightly aggressive with respect to iron and copper, in particular the 903HP.
- The pot's shelf life is approximately 24 hours.

Two-component systems with a catalytic curing system
Resbond™ 906, 908, 919, 920, 944, Durabond™ 950, 952, 954

The colloidal capacity (bond strength) of these products is greater, their watertightness and resistance to chemicals is better than the preceding categories.

- Preparation:
  - Mix the two components according to the weight ratio indicated (see product label). The paste obtained is smooth and homogeneous.
  - Only prepare the quantity of paste required.
  - Avoid foaming and creating air bubbles which would give a porous ceramic.
- Implementation:
  - Apply using a brush, spatula, by impregnation, spraying, dipping or moulding.
- Bonding:
  - Binding precautions identical to those described in the preceding paragraphs.
- Moulding:
  - Create a mould, ideally from soft resin for casting ceramics.
  - Demoulding: use a demoulding agent (vegetable oil).
  - Adhere to the mix ratios (data in percentage by weight)
  - Vibrate and/or agitate the mould to release any air.
  - Cure following the process specific to each adhesive.
- The pot's shelf life ranges from 20 minutes to 2 hours.

Storage

Doping binders should only be incorporated after the liquid and paste mixing phases.

Frequent opening of the pots is detrimental to cements and causes:
- Absorption of water for powders,
- The formation of skin for pre-mixed types
- The oxidisation of components

Frequent use of small quantities: distribute the contents of the packaging into the desired number of small vials after mixing the adhesive. These vials are kept in the storage conditions defined below.

Two-component (powder and binder) ceramic cements: store in a dry place away from sunlight and moisture.

Avoid temperature changes and, in particular, **negative temperatures** (risk of freezing).

Cotronics adhesives keep for 6 months, regardless of whether they are used or not.

Safety

Do not inhale the powders!
Wear a mask when handling in large quantities.
Avoid all contact with the eyes or skin.
In the event of an accident, quickly clean skin and eyes with water and consult a doctor.
We will provide you with the material safety data sheets.

Product Range

Alumina-based ceramic adhesives

Rescor™ 901 – Resbond™ 903HP – 908 – 920 – 989 – 989F – 989FS –940HT

Rescor™ 901, Adhesive and Protective Coating

The refractory adhesive, Rescor™ 901, is a creamy adhesive composed of a pure alumina powder suspended in an inorganic liquid hardening binder (Rescor™901A). These products do not contain asbestos, organic solvents or volatile organic compounds. They are used to harden, coat or impregnate porous surfaces while retaining a certain flexibility.

Properties

- Maximum operating temperature: 1,700 °C
- Peak temperature: 1,780 °C (Rescor™ 901)
- Resistance to thermal shocks, corrosion, oxidisation and erosion
- Insulation against electricity and heat
- Can be used in reducing or oxidising atmospheres
- Resistant to molten non-ferrous metals, steam and most chemicals and solvents
- Increases the resistance, hardness and reflective capacity of mouldable and malleable ceramics.

Applications

- Hard protective coating
- Creation of moulds, potting, electronic or mechanical components
- Coatings for graphite, aluminium, galvanised pipes and tools, induction coils, electrical resistors, heat sensors and thermocouples
- Manufacture of infra-red reflectors for heating resistors
- Assembly and laminating of biosoluble paper, ceramic felt and Rescor™ 360 boards.

Implementation

- Easy application using a brush, spraying or dipping
- Curing at room temperature
- No toxic or unpleasant odour
- Ideal for bonding two flexible materials

- To obtain a compact and rigid mass: add the 901 hardener binder

Rescor™ 901A Binder, Liquid Insulation Hardener

The Rescor™ 901A ceramic binder in liquid phase resists high temperatures. Once cured, it penetrates into the surface of porous ceramics to form a strong ceramic bond. It is composed of extremely fine grains of alumina to optimise its penetrative power.

Implementation

- It can be poured, applied with a brush or by spraying or dipping
- Curing: in 24 hours at room temperature
- Fast curing: in 4 hours at 65 °C
- Use as thinner: with the Rescor™ 901 adhesive

Resbond™ 903HP, High Strength Bonding

The Resbond™ 903HP ceramic adhesive is an alumina compound and is smooth, creamy paste.

Properties

- Maximum operating temperature: 1,650 °C
- Peak temperature: 1,790 °C
- Excellent electrical insulation
- Resistant to liquid metals and many solvents and chemicals
- Can be used in reducing or oxidising atmospheres

Applications

- Bonding of dense ceramics, non-reactive metals and elements that do not withstand water.

Implementation

- Application using a brush, trowel or by spraying
- Application of multiple, thin waterproofing layers
- Curing at room temperature
- Fast curing:
    - 2 hours at 120 °C is sufficient to give the part good adhesion
    - 4 hours at 370 °C are required for total hardening

Resbond™ 908 – Alumina-based adhesive, 1,650 °C

The Resbond™908 adhesive bonds and protects up to 1,650 °C. Its application facilitates high-speed production operations: its viscosity is adjusted for automatic dispensing and measuring.

Properties

- Maximum operating temperature: 1,650 °C
- Not very abrasive
- Good electrical insulator
- Good thermal conductor
- Insoluble in water after curing
- Excellent chemical inertness
- High resistance to chemicals
- Excellent resistance to compression
- High hardness

Applications

- High speed production operations
- Electronic equipment

Implementation

- Easy to use
- Curing in 24 hours at room temperature
- Fast curing in 30 minutes at 120 °C

Resbond™920 – Thermal conductivity and dielectric strength, 1,600 °C

The Resbond™ 920 adhesive is composed of alumina. It can replace up to seven different ceramic cements at certain manufacturing plants.

Properties

- Can be used from 60 °C to +1,500 °C.
- Dielectric strength of 10.5 kV/mm
- Resistivity of 10^9 Ω.m at room temperature

Applications

- Moulding or coating where a combination of high electrical resistance and good thermal conductivity is required
- Bonding pyrometers, heating elements, furnace elements, resistors

Implementation

- Easy to use:
  - Mix the power with distilled water in a ratio of 100 to 14
- Pot life (handling time after mixing): 30 minutes
- Curing in 24 hours at room temperature
- Fast curing: 4 hours at 65 °C.

Resbond™ 989 – High purity adhesive, 1,650 °C

The Resbond™ 989 adhesive is the one-component product with the greatest number of applications in this range. It is composed of two types of alumina particles: the biggest measure between 50 and 120 microns and represent approximately 15 % of the weight of the product, and the smallest measure between 1 and 25 microns.

Applications

- Bonding metals, ceramics, graphites and glass
- Bonding silicon carbide nozzles into a ceramic sleeving
- Bonding nickel pins with a diameter of 0.5 mm into an alumina nitride sleeve during a heat treatment at 900 °C
- Production of heating elements with Kanthal® heating elements and a mullite substrate

Implementation

- Easy to apply with a brush in thin layers
- Can be applied by serigraphy.

Advice for use:

- Mix the paste with a mechanical mixer until it hardens. Mixing should not be less then 3 minutes.
- The smooth, creamy paste should be used within 20 minutes of its preparation, especially if the atmosphere in the workshop is dry.
- If waiting before use, the paste should be stored in a hermetic or humid chamber.
- Complete Curing after a minimum of 4 hours at room temperature or 1 hour at 95°C
- This product is the ideal choice for production applications where automation is required.

Resbond™ 989FS - Fast-setting

This variation of the Resbond™ 989 is a fast-setting adhesive: It fully cure in 120 minutes at 23°C or after 5 minutes at 95°C. This property makes it ideal for applications with automatic dispensing

Resbond™ 989F Pre-Nano Adhesive

This second variant of the Resbond™ 989 is manufactured with a new radial dissipation formula. It combines a high temperature colloidal ceramic with nanometric alumina particles. The ceramic adhesive passes through an ultra-fine sieve to ensure a particle diameter of less than 0.6 µm. Thanks to this specific manufacturing method, it has the ability to bond ultra-fine layers up to 1,650 °C.

Properties

- Maximum operating temperature: 1,650 °C

Applications

- Ideal for automatic dispensing in industrial production

Implementation

- Curing: identical to Resbond™ 989FS

Resbond™ 940HT – General purpose adhesive

The Resbond™940HT adhesive is the general purpose product in this range.

Properties

- Maximum operating temperature: 1,540 °C

Applications

- Resistant to molten metals and most chemicals and solvents
- Can be used in reducing or oxidising atmospheres

TECHNICAL DATA SHEET 3MG.001

Property	Unit	901	903HP	908	920	940HT	989	989FS	989F
Max. Operating Temperature	°C	1,650	1,790	1,650	1,650	1,540	1,650	1,650	1,650
Components		1	1	2	2	2	1	1	1
Appearance		Paint	Paint	Paste	Paste	Paste	Paint	Paint	Creamy
Filler		Al_2O_3	Al_2O_3	Al_2O_3	Al_2O_3	Al_2O_3	Al_2O_3	Al_2O_3	Al_2O_3
Compressive Strength at 20 °C	MPa	8.3	48.3	20.7	31	29	20.7	19.3	24.1
Flexural Strength at 20 °C	MPa	4.1	24.1	7.6	3.1	13.1	7.6	6.5	8.6
Thermal Conductivity	$W.m^{-1}.K^{-1}$	0.29	5.76	2.16	2.16	2.16	2.16	2.16	1.73
Thermal Expansion	$10^{-6}.K^{-1}$	7.2	7.2	8.1	8.1	7.2	8.1	8.1	8.1
Dielectric Strength	kV/mm	7.8	9.75	7.8	10.5	4.9	7.8	7.8	7.8
Resistivity	Ω.m	10^{10}	10^{8}	10^{8}	10^{9}	10^{6}	10^{6}	10^{6}	10^{6}
Mix Ratio	Powder - Binder	-	-	100 - 33	100 -14	100 - 30	-	-	-
Cure at Room Temperature	Hrs	24	-	24	24	24	2h to 4h	30min to 2h	2h to 4h
Fast Cure		2 hrs at 65 °C	2 hrs at 120 °C	30 min at 120 °C	4 hrs at 65 °C	5-10 min at 95 °C	30 min to 1h at 95°C	5 min at 95 °C	1h to 2h at 95°C
Post-Cure		-	4 hrs at 370 °C	-	-	-	-	-	-

Zirconium oxide-based ceramic adhesives
Resbond™ 904 – 940

Resbond™ 904 – One-component for extreme temperatures, 2,200 °C

The Resbond™ 904 adhesive is a smooth, creamy paste prepared solely with zirconium oxide. This composition gives it a thermal resistance in continuous use superior to that of many materials. It is commonly used for binding ceramics and graphite.

Properties

- Thermal resistance up to 2,200 °C
- Good resistivity
- Resistant to oxidisation and erosion
- No wetting
- Can be used in reducing or oxidising atmospheres
- Resistant to many solvents and chemicals

Applications

- Welding
- Brazing
- Bonding and coating
- Conductor seals
- Protection of thermocouples
- Instrumentation
- Preparation of bricks and moulds
- Handling liquid metals
- Thermocouples

Implementation

- Easy to use
- Curing at room temperature

Resbond™ 940 – Fast-setting adhesive, 1,100 °C

The Resbond™ 940 adhesive is fast-setting thanks to its specific activator, the 940T-1. This acts by catalysis and ensures perfect adhesion after 5 to 15 minutes at 93 °C. For optimal conditions, post-curing can be carried out at 120 °C for 4 hours.

Properties

- Thermal resistance up to 1,100 °C
- Fast setting

Ceramic Adhesives

Applications

- Depositing
- Coating
- Bonding
- Impregnation
- Sealing heat and dielectric shields
- Encapsulating temperature sensors
- Bonding steatite bases on lamps in a high speed production chain

Implementation

- In thick or thin layers
- On metals, quartz, graphite, ceramics, high temperature insulators
- Mix the two components according to the recommended mix ratio to obtain a smooth, uniform paste.

Property	Unit	904	940
Max. Operating Temperature	**°C**	2,200	1,093
Components		1	2
Appearance		Paint	Paste
Filler		ZrO_2	ZrO_2
Compressive Strength at 20 °C	**MPa**	41.4	27.6
Flexural Strength at 20 °C	**MPa**	20.7	12.4
Thermal Conductivity	**$W.m^{-1}.K^{-1}$**	2.16	1.15
Thermal Expansion	**$10^{-6}.K^{-1}$**	7.4	8.1
Dielectric Strength	**kV/mm**	9.75	4.9
Resistivity	**Ω.m**	10^6	10^6
Mix Ratio	**Powder - Binder**	-	100-28
Cure at Room Temperature		24 hrs	24 hrs
Fast Cure		4 hrs at 65 °C	5-15 min at 93 °C
Post-Cure		-	4 hrs at 120 °C

Mica-based ceramic adhesives
Resbond™ 907 – 907GF

Resbond™ 907 – Universal adhesive, flame resistant from -130 °C to +1,260 °C

The Resbond™ 907 is composed of mica and a ceramic binder. Its thin, regular or high viscosity can be specified when ordering.

Properties

- Resistant to solvents, electrical and flame resistant
- Breakdown voltage of 12 kV/mm
- Can be used from -130 °C to 1,260 °C.

Applications

- Industrial production
- Exhaust systems, motors, turbines, boilers
- Ideal for steel, iron, lead, ceramics and metals in general.

Implementation

- Texture: paste
- Easy to use
- Curing at room temperature in 24 hours
- Fast curing: 1 hour at 120 °C

Resbond™ 907GF – High temperature sealant, 1,250 °C

The Resbond™ 907GF adhesive forms a mica-based creamy putty. It is packaged in a cartridge for simple and cost-effective application.

Applications

- Production of very thin and waterproof seals at high temperatures
- Construction of engines, turbines, boilers
- Application without preparation on steel, iron, lead, ceramics and metals in general.

Implementation

- Application in cartridge

Ceramic Adhesives

Property	Unit	907	907GF
Max. Operating Temperature	°C	1,260	1,250
Components		1	1
Appearance		Paste	Putty
Filler		Mica	Mica
Compressive Strength at 20 °C	MPa	24.1	10.3
Flexural Strength at 20 °C	MPa	8.6	-
Thermal Conductivity	$W.m^{-1}.K^{-1}$	0.86	0.86
Thermal Expansion	$10^{-6}.K^{-1}$	8.1	-
Dielectric Strength	kV/mm	11.7	5.6
Resistivity	Ω.m	10^{7}	10^{7}
Mix Ratio	Powder - Binder	-	-
Cure at Room Temperature		24 hrs	24 – 48 hrs
Fast Cure		1 hrs at 120 °C	1 hrs at 120-175 °C
Post-Cure		-	-

Silicone-based ceramic adhesives

Resbond™ 905 – 940LE – 940HE – Thermeez™ 7030

Resbond™ 905 – Two-component low expansion adhesive, 1,371 °C

The Resbond™ 905 adhesive contains fused silicone (quartz) and the 905T binder which optimises the homogeneity of the adhesive.

Properties

- Very low expansion coefficient
- Operating temperature: up to 1,371 °C

Applications

- Quartz, corderite and lithium-alumina ceramics

Implementation

- 905T binder for greater uniformity of the adhesive

Resbond™ 940LE – Two-component, low expansion, fast curing, 1,370 °C

The Resbond™ 940LE adhesive is composed of silicone (quartz) and a colloidal binder. The perfect adhesive for bonding low expansion materials, such as quartz lamps, optic fibres or halogen lamps on a high speed production line.

Applications

- Bonding very low expansion materials
- Quartz lamps, optic fibres or halogen lamps
- On a high speed production operations

Implementation

- With a colloidal binder

Resbond™ 940HE – Two-component high expansion adhesive, 980 °C

The Resbond™ 940HE adhesive is used for bonding and moulding very high expansion parts, for example heating elements.

Ceramic Adhesives

Thermeez™ 7030 – "Epoxy-like" adhesive and sealing putty, 950 °C

The Thermeez™ 7030 adhesive brings the ease of use of epoxides into the field of ceramic adhesives.

Properties

- Fireproof and resistant to acids, alkalis, solvents and corrosion
- Operating temperature up to 950 °C
- Guarantees a gas-tight seal even at high temperatures

Applications

- Pipe and pump seals, flanges, diesel engines, heating plants and bonding sensors or ceramic textiles
- Repairing cracked pipes
- Can be used on steel, lead, ceramics and most metals

Implementation

- Mix the products with water, then apply the creamy paste to the intended surface
- Curing in 24 to 36 hours at room temperature
- Fast curing in 4 hours at 65 °C

Property	Unit	905	940LE	940HE	7030
Max. Operating Temperature	°C	1,371	1,370	980	980
Components		2	2	2	2
Appearance		Paste	Paste	Paste	Paste
Filler		SiO_2	SiO_2	SiO_2	SiO_2
Compressive Strength at 20 °C	MPa	22	24.1	29	34.5
Flexural Strength at 20 °C	MPa	14.5	14.5	10	10
Thermal Conductivity	$W.m^{-1}.K^{-1}$	1.44	0.72	1.2	1.2
Thermal Expansion	$10^{-6}.K^{-1}$	0.5	0.7	13.5	13.5
Dielectric Strength	kV/mm	7.8	4.9	3.9	3.9
Resistivity	Ω.m	10^9	10^6	10^7	10^7
Mix Ratio	Powder - Binder	100 - 60	100 - 45	100 - 33	100 - 20
Cure at Room Temperature		-	24 hrs	24 hrs	24-48 hrs
Fast Cure		2 hrs at 120 °C	5-15 min at 93 °C	5-15 min at 93 °C	4 hrs at 65 °C
Post-Cure		-	-	-	-

Magnesium oxide-based ceramic adhesives

Resbond™ 906 - 919

Resbond™ 906 – High thermal expansion, 1,650 °C

The Resbond™ 906 adhesive is prepared with magnesium oxide. It is specially formulated for bonding high expansion materials

Properties

- Very high expansion coefficient ideal for bonding metals
- Operating temperature: 1,650 °C

Applications

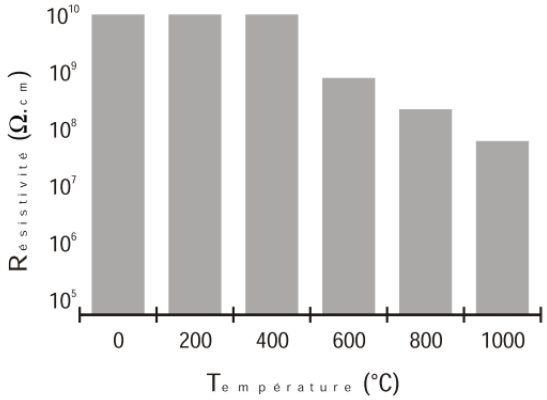
- Bonding with steels, aluminium, brass, copper and metals with a high expansion coefficient

Implementation

- Two-component with a paste-like consistency once mixed
- Viscosity can be adapted with the 906T binder
- Curing at room temperature
- Post-curing at 120 °C minimum for optimal properties

Resbond™ 919 – High dielectric strength, 1,530 °C

Specially formulated with magnesium, the Resbond™ 919 adhesive is the best moulding and bonding material for electrical applications with a dielectric constant of 10.5 kV/mm.



Properties

- Dielectric strength of 270 V/mm
- High mechanical strength
- High and stable dielectric properties even when exposed to cold or hot temperatures

The table opposite shows its electrical resistance according to the temperature.

Applications

- Manufacture of insulators for electrical resistors.

Implementation

- Gradually mix the powder with distilled water.

Note: The optimal ratio of water is 13 to 15 % depending on the ambient humidity and possible degassing conditions.

- Curing in 24 hours at room temperature
- Post-curing at 120 °C for 4 hours for optimal properties

Property	Unit	906	919
Max. Operating Temperature	°C	1,650	1,530
Components		2	2
Appearance		Paste	Paste
Filler		MgO	MgO-ZrO
Compressive Strength at 20 °C	MPa	20.7	31
Flexural Strength at 20 °C	MPa	10.3	3.1
Thermal Conductivity	$W.m^{-1}.K^{-1}$	5.76	0.57
Thermal Expansion	$10^{-6}.K^{-1}$	12.6	4.7
Dielectric Strength	kV/mm	9.75	0.27
Resistivity	Ω.m	10^{7}	10^{9}
Mix Ratio	Powder - Binder	100 - 42	100 -13
Cure at Room Temperature		24 hrs	24 hrs
Fast Cure		-	4 hrs at 120 °C
Post-Cure		-	-

Graphite-based ceramic adhesives
Resbond™ 931 – 931C

Resbond™ 931 – 100 % graphite coating and adhesive, 3,000 °C

The Resbond™ 931 adhesive is formulated with 99 % pure graphite. It can be used to bond graphite or carbon components.

The composition of the Resbond™ 931 product means that it requires specific packaging for the transportation of dangerous goods.

Properties

- Maximum operating temperature: 3,000 °C
- Resistant to liquid metals, oxidising and reducing atmospheres, and most solvents and chemicals
- No contamination of the furnace atmosphere
- Electrical conductor
- Resistant to traction

Example: a graphite-to-graphite bond crated with Resbond™ 931 adhesive ensures a tensile strength of 17.5 MPa

Applications

- Repairing broken or cracked graphite parts: crucibles, fixtures, induction furnace
- Bonding graphite cloths, felts or boards

Implementation

- Mix the graphite powder with its activator.
- Curing at 100 °C minimum to obtain a pure graphite bond
- Post-curing in 16 hours at 130 °C

Resbond™ 931C – Ceramic-filled graphite adhesive, 1,370 °C

Resbond™ 931C is a one-component adhesive filled with ceramic powder and graphite. It is used for bonding graphite to other materials, such as a graphite coating on a metal, glass, ceramic or any other non-porous surface.

Properties

- Good electrical conductor
- Excellent resistance to various chemicals and solvents
- Resistant to oxidisation

Applications

- Bonding graphite to other materials
- Bonding graphite to a metal, glass, ceramic or any other non-porous surface.

Implementation

- Mix to obtain a smooth paste
- Curing in 24 hours at room temperature

Activator binder 931T

The 931T binder is a superior source of fine grain graphite. It is used to laminate the porous surfaces of graphite parts to increase the wear resistance of the treated parts.

The composition of the Resbond™ 931 product means that it requires specific packaging for the transportation of dangerous goods.

Applications

- Sealing agent

Implementation

- Saturation of the surfaces to treat
- Curing at 130 °C
- Overlapping of layers is possible after curing

Property	Unit	931	931C
Code UN		UN2874	-
Max. Operating Temperature	°C	3,000	1,370
Components		2	1
Appearance		Paste	Paste
Filler		Ceramic-Graphite	
Compressive Strength at 20 °C	MPa	20.7	29
Flexural Strength at 20 °C	MPa	10.3	12.4
Thermal Conductivity	$W.m^{-1}.K^{-1}$	8.64	5.76
Thermal Expansion	$10^{-6}.K^{-1}$	7.4	7.4
Dielectric Strength		Conductor*	
Resistivity		Conductor*	
Mix Ratio	Powder - Binder	100 - 35	-
Cure at Room Temperature		-	24 h
Fast Cure		4 hrs at 100 °C	-
Post-Cure	°C	16 hrs at 130 °C	2 hrs at 93 °C

*The presence of small amounts of graphite compromises its insulating properties but is not sufficient for an electrical current to pass through

Metal-filled ceramic adhesives

Resbond™ 940SS and Durabond™ 950 - 952 - 954

Resbond™ 940SS – Stainless steel-based adhesive, 1,100 °C

The Resbond™ 940SS ceramic adhesive is filled with 316 stainless steel. It provides excellent adhesion and resistance to high temperatures. This product cures quickly.

Durabond™ 954 – Stainless steel-based adhesive, 1,100 °C

The Durabond™ 954 ceramic adhesive is filled with stainless steel.

Properties

- Maximum operating temperature up to 1,100 °C
- High expansion coefficient
- Excellent adhesion to clean metal surfaces

Applications

- Bonding series 300 steels, metals and expandable ceramics

Implementation

- Texture: metallic powder.
- An accelerated curing version is available under the reference **Durabond™ 954FS**.

Durabond™ 950 - Aluminium-based adhesive, 650 °C

The Durabond™ 950 ceramic adhesive is filled with aluminium powder. It provides high-strength bonding even at high temperatures. This product is easy to apply and cures at room temperature with a catalyser.

Properties

- Maximum operating temperature: 650 °C
- No porosity
- Ductile
- Resistant to thermal shocks

Applications

- Safe alternative to welding

Implementation

- Supplied as a powder with a specific non-organic binder
  - The mixture forms a creamy paste
- Curing at room temperature with a catalyser

- An accelerated curing version is available under the reference **Durabond™ 950FS**.

Durabond™ 952 – Nickel-based adhesive, 1,100 °C

The Durabond™ 952 ceramic adhesive is filled with nickel powder. It is a low expansion adhesive and can be used up to 1,100 °C. It is formulated for bonding low expansion ceramics and metals.

An accelerated curing version is available under the reference **Durabond™ 952FS**.

Property	Unit	940SS	950	952	954
Max. Operating Temperature	°C	1,093	650	1,093	1,093
Components		2	2	2	2
Appearance		Paste	Paste	Paste	Paste
Filler		Stainless Steel 316	Aluminium	Nickel	Stainless Steel 316
Compressive Strength at 20 °C	MPa	31	27.6	34.5	31
Flexural Strength at 20 °C	MPa	17.2	20.7	20.7	17.2
Thermal Conductivity	$W.m^{-1}.K^{-1}$	1.4	6.34	2.01	1.44
Thermal Expansion	$10^{-6}.K^{-1}$	18	18	7,2	18
Dielectric Strength		Conductor*			
Resistivity		Conductor*			
Mix Ratio	Powder - Binder	100 - 39	100 - 160	100 - 120	100 - 25
Cure at Room Temperature		1-4 hrs	24 hrs	24 hrs	24 hrs
Fast Cure		-	-	-	-
Post-Cure		1 hrs at 93 °C + 1 hrs at 260 °C	2 hrs at 93 °C + 2 hrs at 204–315 °C	2 hrsr at 93 °C 2 hrs at 204–315 °C	2 hrs at 93 °C + 2 hrs at 204–315 °C

*The presence of small amounts of metal in the powder compromises its insulating properties but is not sufficient for an electrical current to pass through

Cotronics 970N Test Kit

The Cotronics 970N test kit includes all the basic and general use products of the 900 range. Some variants of the same adhesive of are not shown. This set of product samples allows you to gain the skills and experience needed for this bonding solution. In terms of testing, you can calmly select the product that is best suited to your application.

The seven high-temperature adhesives have different physical and chemical properties. For example: viscosity, compressive strength, dielectric constant, breakdown voltage, thermal conductivity and expansion.

The kit contains the following Cotronics ceramic adhesives:

- 901
- 907GF
- 919
- 989
- 940
- 950
- 7030

The Cotronics 970N test kit allows you to try small amounts of the products so you can compare the performances relevant to your application. The user guides explain simply how to handle the products to ensure your safety.

Packaging

Item N°	Resin		Hardener	
	Volume	Unit	Volume	Unit
901-1	1.35 kg	Quart US	One-component	
901-2	6.35 kg	Gallon US	One-component	
901-3	25 kg	6 Gallon US	One-component	
901A-1	900 g	Quart US	One-component	
901A-2	4.5 kg	Gallon US	One-component	
901A-3	19.5 kg	Gallon US	One-component	
901T-1	/	/	1 kg	Quart US
903-1	1.35 kg	Pint US	One-component	
903-2	2.7 kg	Quart US	One-component	
903HP-1	1.1 kg	Pint US	One-component	
903HP-2	2.25 kg	Quart US	One-component	
903HP-3	0.75 kg	Pint US	One-component	
903HP-4	6 kg	Gallon US	One-component	
903HPT-1	0.75 kg	Pint US	One-component	
903HPT-2	1.5 kg	Quart US	One-component	
904-1	1.35 kg	Pint US	One-component	
904-2	2.7 kg	Quart US	One-component	
904T-1	/	/	600 g	Pint US
904HP-1	840 kg	Pint US	340 g	Pint US
904HPT-1	/	/	340 g	Pint US
905-1	0.45 kg	Pint US	0.3 kg	BTL 0.25 L
905-2	0.9 kg	Quart US	0.6 kg	Pint US
905-3	3.6 kg	Gallon US	2.2 kg	½ Gallon US
905T-1	0.6 kg	Pint US	One-component	
906-1	0.6 kg	Pint US	200 g	BTL 0.25 L
906-2	1.2 kg	Quart US	400 g	Pint US
906-3	4.5 kg	Gallon US	1.9 kg	½ Gallon US
906T-1	0.6 kg	Pint US	One-component	
907-1	0.45 kg	1/2 Pint US	One-component	
907-2	1.4 kg	Quart US	One-component	
907-3	3.1 kg	½ Gallon US	One-component	
907-4	27.2 kg	5 Gallon US	One-component	
907GF-1	450g	½ Pint US	One-component	
907GF-2	1.5 kg	Quart US	One-component	
907GF-3	3.2 kg	½ Gallon US	One-component	
907GF-5	125 g	3 SR	One-component	
907GF-6	450 g	CT 325 ml	One-component	
907GF-7	500 g	CT 325 ml	One-component	
907H-1	0.45 kg	1/2 Pint US	One-component	
907H-2	1.4 kg	Quart US	One-component	
907H-3	3.1 kg	½ Gallon Us	One-component	
907H-4	27.2 kg	5 Gallon US	One-component	
907T-1	/	/	1.1 kg	Quart US
907TH-1	0.45 kg	½ Pint US	One-component	
907TH-2	1.4 kg	Quart US	One-component	
907TH-3	3.1 kg	½ Gallon US	One-component	
907TH-4	27.2 kg	5 Gallon US	One-component	
907TS-1B	225 g	Tube 120 ml	One-component	
907TS-1G	225 g	Tube 120 ml	One-component	
907TS-1GLD	225 g	Tube 120 ml	One-component	
907TS-1R	225 g	Tube 120 ml	One-component	
908-1	750 g	Pint US	250 g	BTL 0.25 L
908-2	1.3 kg	Quart US	430 g	Pint US
908-3	4.3 kg	Gallon US	1.3 kg	Quart Us

FRANCE : 4 avenue de Strasbourg – 68350 Didenheim – Tel : +33 (0) 3 67 78 78 78
DEUTSCHLAND: Basler Strasse 115 – 79115 Freiburg – Tel: + 49 (0) 761 47 87 336
www.final-materials.com

TECHNICAL DATA SHEET 3MG.001

Item N°	Resin		Hardener	
	Volume	Unit	Volume	Unit
908T-1	/	/	500 g	Pint US
918-1	0.9 kg	Quart US	Water	
918-2	3.6 kg	Gallon US	Water	
918T-1	1.25 kg	Quart US	One-component	
919-1	1.4 kg	Quart US	Water	
919-2	5.4 kg	Gallon US	Water	
919-3	22.7 kg	5 Gallon Us	Water	
920-1	1.55 kg	Quart US	Water	
920-2	6.35 kg	Gallon US	Water	
920-3	22.7 kg	5 Gallon US	Water	
931-1	350 g	Pint US	90 g	BTL 90 ml
931-2	700 g	Quart US	200 g	BTL 240 ml
931T-1	/	/	450 g	Pint US
931T-2	/	/	900 g	Quart US
931C-1	0.68 kg	Pint US	One-component	
931C-2	1.35 kg	Quart US	One-component	
931C-4	5.4 kg	Gallon Us	One-component	
931CT-1	/	/	630 g	Pint US
940-1	1.25 kg	Quart US	300 g	BTL 240 ml
940-2	4.5 kg	Gallon US	1.2 kg	Quart US
940HE-1	350 g	Pint US	150 g	BTL 120 ml
940HE-2	700 g	Quart US	325 g	BTL 240 ml
940HE-3	2.7 kg	Gallon Us	1.4 kg	Quart US
940HT-1	700 g	Pint US	225 g	BTL 240 ml
940HT-2	1.4 kg	Quart US	450 g	3/4 Pint US
940HT-3	4.0 kg	Gallon US	900 g	Quart US
940LE-1	350 g	Pint US	150 g	BTL 90 ml
940LE-2	700 g	Quart US	300 g	BTL 240 ml
940LE-3	2.7 kg	Pint US	900 g	Quart US
940SS-1	0.45 kg	1/2 Pint US	175 g	BTL 120 ml
940SS-2	0.9 kg	Quart US	350 g	BTL 240 ml
940SS-3	3.6 kg	Gallon us	1.4 kg	Quart US
940SST-1	/	/	0.45 L	Pint US
940T-1	/	/	580 g	Pint US
944-1	0.9 kg	Quart US	Water	
944-2	3.6 kg	Gallon US	Water	
950-1	0.45 kg	Pint US	0.45 kg	BTL 240 ml
950-2	0.9 kg	Quart US	0.9 kg	Pint US
950-3	3.15 kg	Gallon US	1.9 kg	½ Gallon US
950T-1	/	/	700 g	Pint US
950FS-1	500 g	Pint Us	300 g	235 ml
950FS-2	1.0 kg	Quart US	600 g	Pint US
952-1	250 g	1/2 Pint US	250 g	
952-2	500 g	Pint US	500 g	
952-3	2.0 kg	Gallon US	2.8 kg	Gallon US
952T-1	/	/	540 g	Pint US
952FS-1	250g	½ Pint US	340 g	
954-1	0.45 kg	1/2 Pint US	175 g	
954-2	0.9 kg	Pint US	350 g	
954-3	3.5 kg	Gallon US	950 g	Quart US
954T	700 g	Pint US	One-component	
954T-1	/	/	700 g	Pint Us
954FS-1	450 g	Pint US	175 g	120 ml
954FS-2	900 g	Quart US	350 g	235 ml
954FS-3	3.6 kg	Gallon US	1.4 kg	½ Gallon US
970 N	6 x 90 ml kit and 1 x 30 ml syringe			

FRANCE : 4 avenue de Strasbourg – 68350 Didenheim – Tel : +33 (0) 3 67 78 78 78
DEUTSCHLAND: Basler Strasse 115 – 79115 Freiburg – Tel: + 49 (0) 761 47 87 336
www.final-materials.com

TECHNICAL DATA SHEET 3MG.001

Item N°	Resin		Hardener	
	Volume	Unit	Volume	Unit
989-1	2 kg	Quart US	One-component	
989-2	7.2 kg	Gallon US	One-component	
989-3	20.4 kg	5 Gallon US	One-component	
989F-1	0.95 kg	Pint US	One-component	
989F-2	1.95 kg	Quart US	One-component	
989FS-1	1.1 kg	Pint US	One-component	
989FS-2	2.2 kg	Quart US	One-component	
989FS-3	8.2 kg	Gallon US	One-component	
989T-1	0.54 kg	Pint US	One-component	
989T-2	/	/	3.6 kg	Gallon Us
989FT-1	/	/	0.5 kg	Pint US
989FT-2	/	/	3.6 kg	Gallon US
7030-1	0.9 kg	Quart US	Water	
7030-2	3.6 kg	Gallon US	Water	
7030-3	22.7 kg	5 Gallon US	One-component	

BTL: bottle / CT: cartridge / SR: Syringe

Weights are for information only, Cotronics fills containers by volume.

One-component product

Two-components product

Syringue

Tube

FRANCE : 4 avenue de Strasbourg – 68350 Didenheim – Tel : +33 (0) 3 67 78 78 78
DEUTSCHLAND: Basler Strasse 115 – 79115 Freiburg – Tel: + 49 (0) 761 47 87 336
www.final-materials.com