



Science.
Applied to Life.™

3M™ Specialty Glasses

Inspiring innovation.

High performance glass powders, flakes, cullet and custom glass compositions, used in fabricating a wide range of specialized electronic and mechanical components. Precision manufactured for unmatched consistency, batch after batch.





Today's technologies.

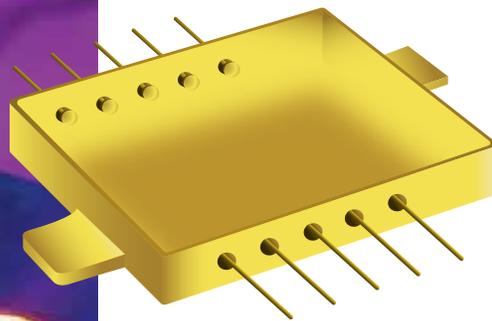
From precision electronics to alternative energy sources, one versatile family of materials is breaking new ground – and it all begins with glass. For designers and manufacturers of high technology components, 3M™ Specialty Glasses offer a number of important advantages over metals, plastics and other materials. Combining hardness with light weight, these specialty glasses have the ability to withstand extremely high temperatures, are highly resistant to corrosion and wear and have excellent electrical insulation properties. In addition, these materials can be formulated to exhibit a wide range of desired electrical and sealing properties.



Tomorrow's breakthroughs.

Precision manufactured for quality & consistency

Manufactured by Ceradyne, Inc., a 3M company, 3M specialty glasses are backed by 50 years of insight and experience in glass design, engineering and production. We offer a wide range of glass formulations, available as powders, flakes, crizzled frit or in forms custom milled to your specific particle size specifications – including custom compositions tailored for desired properties. We are ready to assist you, from the initial design and development phase through scale-up and full-scale production, with analytical support and quality control provided in-house. Our specialty glass facility, located in Seattle, Washington, is ISO 9001:2008 Certified.



3M specialty glasses for sealing applications can be provided in spray-dried form with integrated binders or custom ground to your particle size specifications.

Typical applications for 3M™ Specialty Glasses

Dielectric fluxes and termination pastes for ceramic capacitors

Solar cell pastes

Conductive, resistive and dielectric thick film pastes

Resistor overglazes

Varistor coatings

Dielectric coatings

Glass-to-metal, glass-to-ceramic, glass-to-glass seals

Plasma display components

Low-Temp Co-Fired Ceramic systems (LTCC) for high frequency circuits

Battery header seals

Dielectrics for multilayer circuits

Recrystallizable pastes

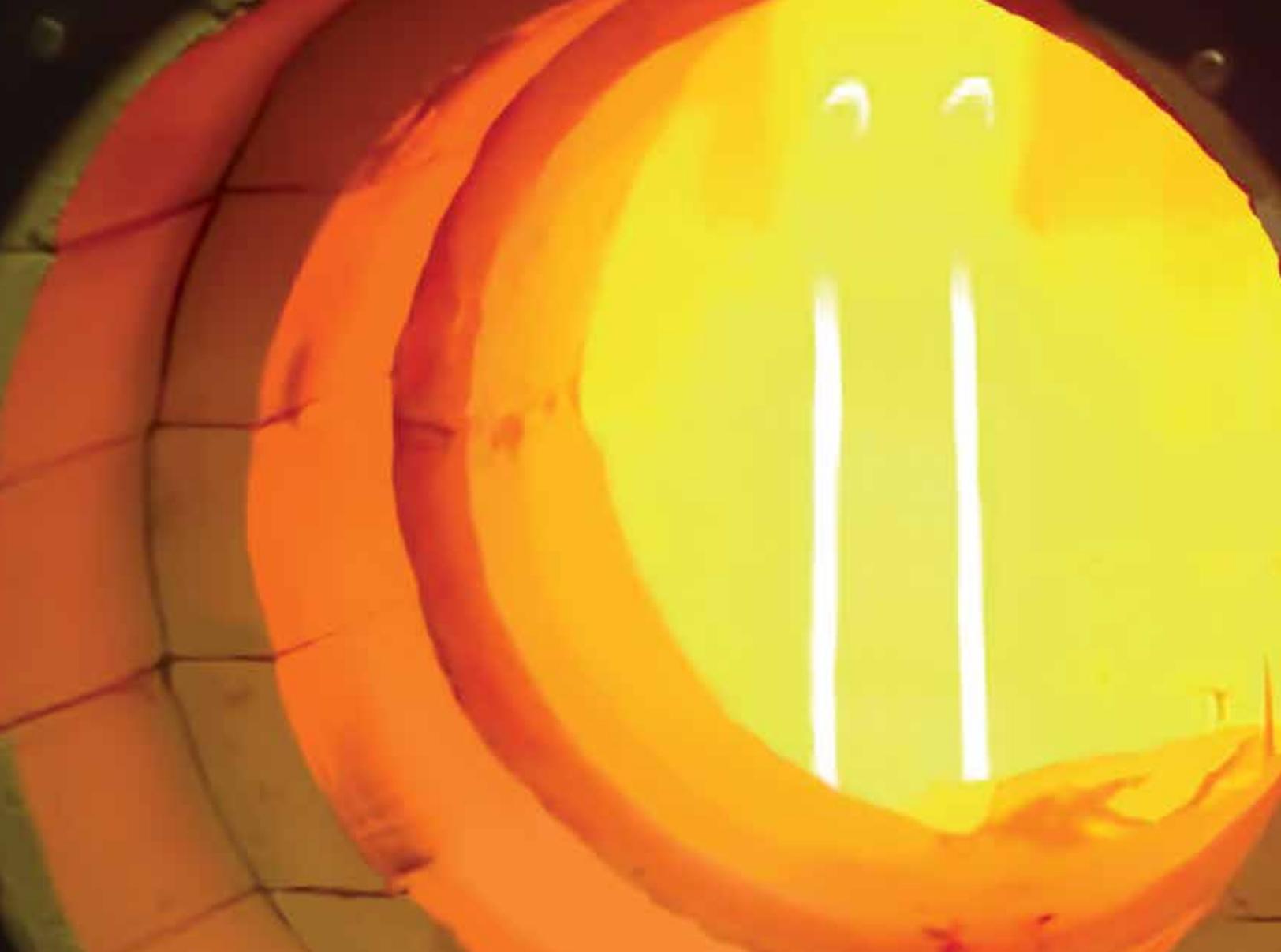
Automotive sensor applications

Fuel cell sealants

Aerospace thermal protection



We offer specialty glass formulations in both porous and non-porous versions. Typical applications include dielectric components, anodic bonding, water getters, thermal protection (heat shields) and high-temperature applications.



Applications



3M specialty glasses can be used in the manufacture of chip components, such as multi-layer ceramic capacitors (MLCC) and inductor termination pastes. Reduction resistant glasses suitable for base-metal electrode (BME) terminations in reducing atmospheres are also available.



We offer a unique line of glasses suitable for low temperature sealing applications such as displays and silicon bonding.



Industries Served

3M™ Specialty Glasses used in conductive pastes for solar cell fabrication are melted in platinum vessels to help ensure highly consistent physical properties and to prevent the intrusion of impurities.

Electronics & Semiconductor

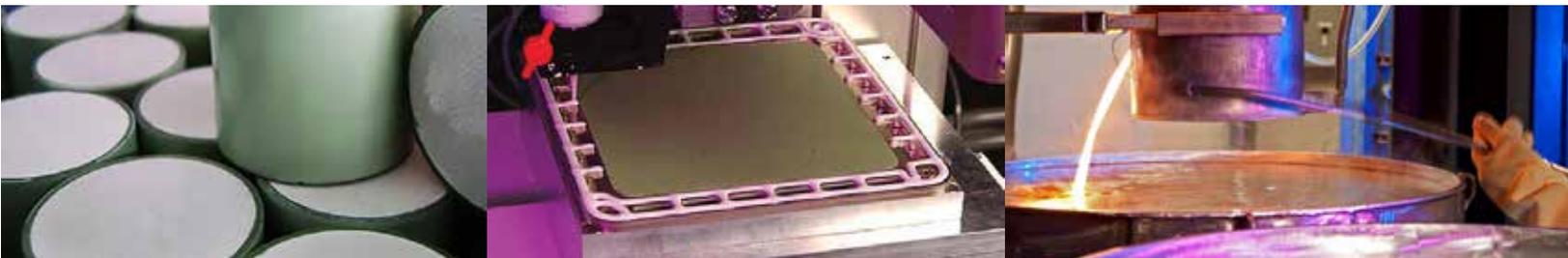
Glass is used in a wide variety of electronic components, typically as an insulating material. It is also used as a sealing material and as an encapsulant for diodes. These glasses are often colored to aid in assembly; to add aesthetic appeal; for branding and identification; and for technical reasons, such as optimizing laser absorption. We can supply you with glass systems pre-blended with a wide range of standard and custom colors – including deep black. When you use pre-colored 3M™ Specialty Glass mixtures, you can help simplify your manufacturing and supply chain processes – all with confidence that your glassed components will be consistently-colored, batch after batch.

Solar Power

We offer a full line of specialty glasses suitable for the conductive pastes used in solar cell fabrication. The glasses are melted in platinum vessels, helping to ensure highly consistent physical properties and preventing unwanted impurities. Solar cell manufacturers add the 3M specialty glass powders to electrically conducting powdered metals, such as silver or aluminum. The resulting paste is applied in thin bands to the polycrystalline silicon wafer, and acts as an extremely efficient conduit to transport electrons from the solar wafer to the connection box.

Glass Fiberizing

For specialized fiberglass manufacturing applications, we can provide customers with standard fiberglass compositions, such as E & S glass, and made-to-order glass compositions, available as crizzled frit or thin flakes. We have years of experience in blending fiberglass-grade glasses with various oxides and other additives to achieve desired properties, such as high thermal expansion or a specific fiber diameter. Both standard and custom glass compositions can be provided in virtually any quantity, including small batches suitable for experimental or developmental applications. Our experts will work with you to select the composition optimized for your specifications.



A variety of 3M specialty glasses are suitable for use as insulating coatings on Metal Oxide Varistors (ZnO “blocks”). These include powders sized for wet application by dipping, rolling or spraying, and for application by dry electrostatic techniques.

Specialized glass and glass-ceramic options can be utilized as compliant or viscous seals in Solid Oxide Fuel Cell (SOFC) applications.

We offer a full line of specialty glasses suitable for thick film applications such as overlayers, resistors, conductors and terminations.



Products & Services

- Glass frits
- Press ready granulation
- Calcined compositions
- Glass powders
- Custom glass formula development
 - Composition engineering to meet your requirements
 - Development phase partnering
 - Scale-up melting
- Large volume manufacturing

In-house Testing of Critical Physical Properties

- Density (helium gas pycnometer)
- Softening Point (Labino technique)
- Thermal Mechanical Analysis (TMA)
 - Coefficient of Thermal Expansion, CTE
 - Glass Transition Temperature, T_g
 - Dilatometric Softening Point, T_s
- TG/DTA
 - Crystallization Peaks, T_x
 - Gravimetric Loss
 - Glass Transition Temperature, T_g
- Powder Particle Size Distribution (Malvern laser)
- Surface Area (BET method)
- Dielectric Constant & Dissipation Factor
- Moisture Content
- Optical bench hot stage microscope

Manufacturing

- Pre-production verification with lab melting/milling and characterization
- Melting in platinum and ceramic crucibles (platinum crucibles are acid cleaned to prevent cross contamination)
- Appropriate selection of raw materials
- Detailed batching procedure
 - Computerized adjustments for equivalencies & minor ingredients
 - Computerized bar code guided batching
 - Lot identification, control and traceability
- Precise melt control
 - Composition-specific production procedures
 - Three melt temperature readings
 - Preset time-temperature profiles with PID controllers
 - Temperature control with alarms for consistent thermal history
- Quenching procedures optimized for glass type
 - De-ionized water quenched
 - Dry roller quenching
 - Constant melt temperature throughout pour
 - Rapid quenching for crystallization-sensitive glasses
- Closed system for water frit casting/drying/prepackaging
- Advanced powder processing
 - Composition-specific milling procedures
 - Wet, dry ball mills, vibratory mills, high volume capability
 - Grind to specific median particle size and/or surface area
 - Dry or wet screening, various mesh sizes
 - Consistent quality, high volume spray drying
- High energy bead mills for nanoscale particles
- Micro-replication; glass beads, glass bubbles, special shaped particles

Quality Control

- Strict calibration program
- Measurement Systems Analysis
- Statistical Process Control (SPC)
- Certified quality management system

Facilities

- Range of furnace sizes for scale-up: 18 liter to 200 liter
- Ability to handle heavy metal oxides and other toxic materials
 - Operate to applicable environmental and safety regulations
 - Air collection at dozens of critical process points
 - Appropriate bag houses and scrubbers
 - Plant wide central vacuum cleaning system
 - Plant wide central water collection and treatment

Product is manufactured and sold by Ceradyne, Inc., a 3M company.

Warranty, Limited Remedy, and Disclaimer: Many factors beyond Ceradyne's control and uniquely within user's knowledge and control can affect the use and performance of a Ceradyne product in a particular application. User is solely responsible for evaluating the Ceradyne product and determining whether it is fit for a particular purpose and suitable for user's method of application. User is solely responsible for evaluating third party intellectual property rights and for ensuring that user's use of Ceradyne product in user's product or process does not violate any third party intellectual property rights. Unless a different warranty is specifically stated in the applicable product literature or packaging insert, Ceradyne warrants that each Ceradyne product meets the applicable Ceradyne product specification at the time Ceradyne ships the product. CERADYNE MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OF NON-INFRINGEMENT OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE. If the Ceradyne product does not conform to this warranty, then the sole and exclusive remedy is, at Ceradyne's option, replacement of the Ceradyne product or refund of the purchase price.

Limitation of Liability: Except where prohibited by law, Ceradyne will not be liable for any loss or damages arising from the Ceradyne product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

Technical Information: Technical information, recommendations, and other statements contained in this document or provided by Ceradyne personnel are based on tests or experience that Ceradyne believes are reliable, but the accuracy or completeness of such information is not guaranteed. Such information is intended for persons with knowledge and technical skills sufficient to assess and apply their own informed judgment to the information. No license under any Ceradyne or third party intellectual property rights is granted or implied with this information.



Ceradyne, Inc., a 3M company

6701 Sixth Ave. South
Seattle, WA 98108

Phone 206-763-2170
Web www.3M.com/specialtyglass

Please recycle. Printed in USA.
© 3M 2016. All rights reserved.
Issued: 7/16 11714HB
98-0050-0021-5

3M is a trademark of 3M Company.
Used under license by
3M subsidiaries and affiliates.