

3M Advanced Materials Division

# 3M™ Specialty Glass Lead-Free

## Introduction

Ceradyne, Inc., a 3M company, offers a line of lead-free glasses suitable for a wide variety of applications. 3M™ Specialty Glasses are melted in platinum lined vessels, helping to ensure consistency of physical properties and preventing unwanted impurities. Glass powders are

custom ground to specific particle size requirements. The following table lists our most common formulations. If your application requires a glass different than those listed, contact our glass development team for additional options and glass samples.

In the table below, the following conditions apply:

- Ideal Flow Temperature - Bulk glass flow exhibited with low viscosity and improved substrate wetting and the noted temperature.
- Normal variation should be expected.
- Flow temperature is for 100% glass and 10-minute soak time at temperature.
- Flow characteristics could be altered by additives and varied glass ratios in the end application.

## Typical Physical Properties (Not for specification purposes)

Glass #	Density (g/cc)	Softening Point (°C)	CTE (x10 <sup>-7</sup> /°C)	Tg (°C)	Ts (°C)	Minimum Flow Temperature (°C)	Ideal Flow Temperature (°C)	Primary Glass Constituents
V1447	4.48	619	67.5	520	568	650	700-800	Bi <sub>2</sub> O <sub>3</sub> -SiO <sub>2</sub> -BaO-ZnO-B <sub>2</sub> O <sub>3</sub> -Al <sub>2</sub> O <sub>3</sub>
V1467	4.89	574	67.1	501	539	600	600-650	Bi <sub>2</sub> O <sub>3</sub> -ZnO-B <sub>2</sub> O <sub>3</sub> -SiO <sub>2</sub> -La <sub>2</sub> O <sub>3</sub> -Al <sub>2</sub> O <sub>3</sub>
V1493	2.49	688	47.7	539	612	800	800-850	B <sub>2</sub> O <sub>3</sub> -SiO <sub>2</sub> -BaO-Al <sub>2</sub> O <sub>3</sub>
V1558	3.18	559	65.0	479	511	600	600-650	ZnO-B <sub>2</sub> O <sub>3</sub> -SiO <sub>2</sub> -Li <sub>2</sub> O
V1560	3.34	575	73.9	501	536	700	700-800	B <sub>2</sub> O <sub>3</sub> -BaO-ZnO-SiO <sub>2</sub> -Li <sub>2</sub> O
V2079	6.83	467	101.8	408	437	550	600-750	Bi <sub>2</sub> O <sub>3</sub> -ZnO-SiO <sub>2</sub> -B <sub>2</sub> O <sub>3</sub> -Al <sub>2</sub> O <sub>3</sub>
V2082	3.50	734	94.8	651	696	750	750-800	SiO <sub>2</sub> -SrO-B <sub>2</sub> O <sub>3</sub> -Al <sub>2</sub> O <sub>3</sub>
V2083	5.33	599	89.7	514	543	600	600-800	SiO <sub>2</sub> -SrO-Bi <sub>2</sub> O <sub>3</sub> -B <sub>2</sub> O <sub>3</sub> -Al <sub>2</sub> O <sub>3</sub>
V2109	3.27	771	79.0	682	736	800	800-850	SiO <sub>2</sub> -SrO-B <sub>2</sub> O <sub>3</sub> -Al <sub>2</sub> O <sub>3</sub>
V2110	3.24	756	76.4	663	714	800	800-850	SiO <sub>2</sub> -SrO-B <sub>2</sub> O <sub>3</sub> -Al <sub>2</sub> O <sub>3</sub>
V2124	3.34	598	72.9	519	562	650	650-800	B <sub>2</sub> O <sub>3</sub> -ZnO-BaO-SiO <sub>2</sub> -Li <sub>2</sub> O
V2125	3.38	581	84.2	502	545	700	700-800	SiO <sub>2</sub> -ZnO-BaO-B <sub>2</sub> O <sub>3</sub> -Li <sub>2</sub> O
V2126	3.21	596	80.3	516	557	650	650-800	B <sub>2</sub> O <sub>3</sub> -SiO <sub>2</sub> -BaO-ZnO-Li <sub>2</sub> O
V2209	6.57	476	95.7	420	453	550	600-700	SiO <sub>2</sub> -Bi <sub>2</sub> O <sub>3</sub> -ZnO-B <sub>2</sub> O <sub>3</sub> -SrO-Al <sub>2</sub> O <sub>3</sub>
V2211	6.64	484	95.3	430	459	550	550-700	SiO <sub>2</sub> -Bi <sub>2</sub> O <sub>3</sub> -ZnO-B <sub>2</sub> O <sub>3</sub> -SrO-ZrO <sub>2</sub>
V2280	3.21	597	78.8	506	551	700	700-850	SiO <sub>2</sub> -ZnO-B <sub>2</sub> O <sub>3</sub> -SrO-Li <sub>2</sub> O
V2282	3.43	602	91.5	504	552	700	700-850	B <sub>2</sub> O <sub>3</sub> -SrO-ZnO-SiO <sub>2</sub> -Al <sub>2</sub> O <sub>3</sub> -Li <sub>2</sub> O
V2289	5.96	535	107.4	455	494	550	550-700	SiO <sub>2</sub> -Bi <sub>2</sub> O <sub>3</sub> -SrO-ZnO-B <sub>2</sub> O <sub>3</sub>
V2290	5.69	552	104.6	460	502	600	600-700	SiO <sub>2</sub> -Bi <sub>2</sub> O <sub>3</sub> -SrO-BaO-ZnO-B <sub>2</sub> O <sub>3</sub>
V2291	5.37	582	107.2	492	533	600	600-700	SiO <sub>2</sub> -Bi <sub>2</sub> O <sub>3</sub> -SrO-BaO-ZnO-B <sub>2</sub> O <sub>3</sub> -Li <sub>2</sub> O
V2297	3.46	578	82.2	483	524	700	700-800	SiO <sub>2</sub> -BaO-ZnO-B <sub>2</sub> O <sub>3</sub> -CuO-Li <sub>2</sub> O
V2300	3.32	590	80.2	497	540	700	700-800	SiO <sub>2</sub> -ZnO-B <sub>2</sub> O <sub>3</sub> -SrO-CuO-TiO <sub>2</sub> -Li <sub>2</sub> O
29610	5.27	537	93.4	466	503	600	700-800	B <sub>2</sub> O <sub>3</sub> -Bi <sub>2</sub> O <sub>3</sub> -BaO-ZnO-SiO <sub>2</sub> -Al <sub>2</sub> O <sub>3</sub>

## About Ceradyne Specialty Glass Materials Services

We can provide you with custom designed glass formulations to meet desired properties. Glass powders can also be custom milled to your specific particle size specifications. Physical limitations may apply. Contact your Ceradyne technical representative for more information.

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. For additional options and glass samples, contact our glass development team at [specialtyglass@mmm.com](mailto:specialtyglass@mmm.com).

## Product Storage, Handling and Safety

**Storage:** Material should be stored in sealed containers. When handling have adequate ventilation or respiratory protection available according to local, state and federal regulations.

**Handling:** Spills should be cleaned up with a shovel or vacuum depending on size of spill. Take care not to inhale or ingest dust. Recovered material should be stored in a sealed container for disposition. Waste to be disposed of according to local, state and federal regulations.

**Safety:** For worker protection, please consider the following:

- Use safety goggles or safety glasses with side shields for eye protection.

- The use of protective gloves is recommended. Wear protective clothing so as not to contaminate personal clothing or shoes.
- Use with appropriate local exhaust ventilation/dust collection to meet standards for T.L.V. If local exhaust is not adequate in controlling exposure, use an appropriate NIOSH/MSHA approved dust/fume respirator in accordance with OSHA regulations.

For additional information about personal protective equipment, refer to the product Safety Data Sheet.

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

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