

3M Advanced Materials Division

3M™ 11B Enriched Boron

Introduction

3M™ 11B Enriched Boron was developed to meet the specialized needs of the silicon wafer industry, because boron is the only p-dopant suitable for silicon. ¹¹B enriched boron is also suitable for unique applications in the nuclear power industries.

Crystalline Boron

3M Technical Ceramics, Inc. uses a unique proprietary process to produce crystalline elemental boron enriched in either ¹⁰B or ¹¹B. Because the material only contains boron, maximum utilization of isotope properties is possible.

Crystalline ¹¹Boron represents the opposite of crystalline ¹⁰Boron in terms of neutronic performance, having an extremely low thermal neutron absorption cross section. This high purity product maximizes the amount of ¹¹Boron available and is considered to be neutron transparent. It is utilized when neutron absorption is not desired. 3M Technical Ceramics, Inc. can produce a wide variety of enrichments in this crystalline material. We provide certified analytical reports on each lot of crystalline boron delivered.

Typical Physical Properties

(Not for specification purposes)

Properties	Crystalline ¹¹ Boron
Enrichment	to 99%
Molecular Weight	11.00 for 99% ¹¹ B
Crystalline Structure	Beta Rhombohedral
Density	2.38 g/cm ³ for 99% ¹¹ B
Thermal (n,∞) Cross Section (Barns)	0.005
Atomic Mass Number	11.00931

Crystalline Boron Typical Impurities (by weight)*

Element	Quantity (ppm)	Element	Quantity (ppm)
Si	<400	Ni	2
Fe	<10	Al	<5
Mg	4	Cr	2
Ca	<10	Ta	<10
Cu	1	Ti	<10
Na	<10		

*Lot analysis will vary and may show trace quantities of additional elements

Typical Particle Size -40 +230 mesh

Boron Enrichment Capabilities

3M Technical Ceramics, Inc. is a leading global commercial processor of enriched boron, and is one of the largest boron isotope enrichment facilities in the world today. We focus on manufacturing optimized materials with an emphasis on stable

boron isotopes. Our proprietary manufacturing processes allow ¹⁰B and ¹¹B enrichment from natural occurring ratios up to levels exceeding 99% isotopic purity. We offer secure supply, consistent product quality and the ability to custom engineer products for your unique applications. Our specialists are experts at solving materials-related problems in the demanding nuclear and semiconductor industries. For more information, contact us at boron@mmm.com.

Analytical Services

As a manufacturer of specialty, high purity chemical and isotopic products, 3M Technical Ceramics, Inc. maintains sophisticated analytical and testing capabilities at its manufacturing facility in Quapaw, OK. Our analytical laboratories support on-site production activities and provide our customers with data and evidence that the products they receive meet or exceed their requirements. Our laboratories are fully equipped with current-generation instruments to perform a full range of testing procedures, including: inductively coupled plasma mass spectrometry; atomic absorption spectroscopy; ion and gas chromatography; carbon/sulfur and oxygen/nitrogen analysis; particle size analysis and BET surface area measurement.

Product Storage, Handling and Safety

Storage: Store away from heat. Store away from acids. Store away from oxidizing agents. See product Safety Data Sheet (SDS) for additional information.

Handling: Avoid breathing dust/fume/gas/mist/vapors/spray. Do not eat, drink or smoke when using this product. Wash thoroughly after handling. Avoid contact with oxidizing agents (e.g. chlorine, chromic acid, etc.). Dust clouds of this material in sufficient concentration in combination with an ignition source may be explosive. Dust deposits should not be allowed to accumulate on surfaces because of

the potential for secondary explosions. Routine housekeeping should be instituted to ensure that combustible dusts do not accumulate on surfaces. Solids can generate static electricity charges when transferred and in mixing operations sufficient to be an ignition source. Evaluate the need for precautions, such as grounding and bonding, low energy transfer of material (e.g. low speed, short distance), or inert atmospheres. See product SDS for additional information.

Safety: Handling of this product may be hazardous. May form combustible dust concentrations in air. See product SDS for additional information.

Regulatory Summary

One or more components in this material are approved for specific commercial use under a U.S. EPA Low Volume Exemption. Approved commercial use:

1. Resistivity dopant for silicon metals.

See product SDS for additional information.

Product is manufactured and sold by 3M Technical Ceramics Inc.

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14980HB98-0050-0320-1 Rev. C