

3M Advanced Materials Division

# 3M™ 10B Enriched Boron Carbide

## Introduction

3M Technical Ceramics, Inc. offers a range of enriched boron-10 materials designed for the nuclear power industry. These materials can be isotopically tailored to meet individual customer specifications. 3M™ 10B Enriched Boron Carbide offers excellent thermal stability and gamma discrimination, along with a high thermal neutron absorption cross-section. These properties make 3M 10B enriched boron carbide ideal for applications in neutron detecting technologies.

3M 10B enriched boron carbide can be manufactured to meet existing industry standards, such as ASTM C750 and ASTM C751, or more stringent requirements as required by specific customer applications. Where necessary, naturally occurring isotopic materials can be synthesized to comply with unique purity and stoichiometry requirements. 3M Technical Ceramics has refined the manufacturing process for enriched boron carbide by using enriched boric acid as a precursor material. This process allows greater flexibility in chemistry and physical properties. For example, we can produce boron carbide with specific B to C ratios, enrichments and particle sizes to meet your specifications.

## Typical Physical Properties

(Not for specification purposes)

Composition	Units	3M™ 10B Enriched Boron Carbide
Boron Enrichment	% <sup>10</sup> B	≥96%
Composition B+C	wt%	95% min.
Boron Content	wt%	74 - 79
Carbon (by difference)	wt%	21 - 26

## Typical Impurities Analysis\*

(Not for specification purposes)

Impurity	Units	Amount Present
Iron	ppm	150
Silicon	ppm	100
Calcium	ppm	<50
Manganese	ppm	50
Sodium	ppm	25
Titanium	ppm	100
Aluminum	ppm	100
Magnesium	ppm	<25

\* Lot analysis will vary and may show traces of other elements.

## Typical Particle Sizes

**Screened:** 90% - 60 mesh  
90% - 140 mesh

**Fine:** D90 <22.5 micron

**Ultrafine:** D90 <5 micron



3M 10B enriched boron carbide is available in many powder variations; we can also convert these powders into final articles (such as pellets, plates or sputtering targets) in our hot pressing facility. We have extensive experience fabricating, cutting and grinding high-density boron carbide to meet customer requirements.

3M 10B enriched boron carbide is available in quantities from a few hundred grams to thousands of kilograms. It is packaged in fiber drums or poly bottles, protected by a vapor barrier bag. Certified isotopic, spectographic, and total boron and total carbon analyses are provided with every lot.

## Boron Enrichment Capabilities

3M Technical Ceramics 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 <sup>10</sup>B and <sup>11</sup>B 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](mailto:boron@mmm.com).

## Analytical Services

As a manufacturer of specialty, high purity chemical and isotopic products, 3M Technical Ceramics maintains sophisticated analytical and testing capabilities at our manufacturing facility in Quapaw, OK. Our analytical laboratories support on-site production activities and assure our customers 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.

## Toll Pressing

3M Technical Ceramics owns and operates two of the largest vacuum hot presses in the United States. Designed to press powdered ceramic materials into highly dense shapes, these presses are capable of extremely high temperatures and pressures while maintaining the protection of a vacuum or inert gas atmosphere. 3M Technical Ceramics' toll pressing services utilize customer owned or provided starting material to achieve final shapes and product characteristics. At these extreme conditions, only simple shapes such as blocks, cubes, plates and cylinders are possible. We have extensive experience pressing boron carbide, boron nitride, silicon carbide, titanium and zirconium diborides, aluminum nitride and several customer proprietary materials. The capabilities of these presses are as follows:

Pressing Force	400 and 700 tons
Temperatures	To 2200°C (3992°F)
Vacuum	To 40 microns
Die Size	34 in. diameter 60 in. tall
Typical Die Material	Carbon/graphite

## Product Storage, Handling & Safety

**Storage:** Store away from heat. 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.) See SDS for additional information.

**Safety:** Handling of this material may be hazardous. Avoid skin and eye contact. Avoid breathing of vapors, mists or dusts. Keep away from all sources of ignition. Do not eat, drink or smoke when handling this material. See SDS for additional information.

## Regulatory Summary

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

1. As an intermediate
2. As a neutron absorber in various nuclear applications, i.e. shields for nuclear radiation, neutron detection, instruments, nuclear control rods, boron neutron capture therapy.

See SDS for additional information.

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

**Warranty, Limited Remedy, and Disclaimer:** Many factors beyond 3M Technical Ceramics' control and uniquely within user's knowledge and control can affect the use and performance of a 3M Technical Ceramics product in a particular application. User is solely responsible for evaluating the 3M Technical Ceramics 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 3M Technical Ceramics 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, 3M Technical Ceramics warrants that each 3M Technical Ceramics product meets the applicable 3M Technical Ceramics product specification at the time 3M Technical Ceramics ships the product. 3M Technical Ceramics 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 3M Technical Ceramics product does not conform to this warranty, then the sole and exclusive remedy is, at 3M Technical Ceramics' option, replacement of the 3M Technical Ceramics product or refund of the purchase price.

**Limitation of Liability:** Except where prohibited by law, 3M Technical Ceramics will not be liable for any loss or damages arising from the 3M Technical Ceramics 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 3M Technical Ceramics personnel are based on tests or experience that 3M Technical Ceramics 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 3M Technical Ceramics or third party intellectual property rights is granted or implied with this information.

**Export Control.** The 3M Technical Ceramics product(s) listed here may be controlled commodities under applicable U.S. export control laws and regulations, including, but not limited to, the U.S. International Traffic in Arms Regulations (ITAR) and the Export Administration Regulations (EAR). These laws and regulations may, among other things, prohibit the export and/or reexport of controlled product(s) to any or all locations outside of the United States without prior U.S. Government export authorization, the sharing of export controlled technical data and services with those anywhere who are not U.S. citizens or U.S. permanent residents, dealings with U.S. Government, United Nations and other "Restricted Parties," and proliferation activities including those that further nuclear, chemical, or biological warfare, missile stockpiling/use, or the use of rockets or unmanned aerial vehicle systems. 3M Technical Ceramics and purchasers or prospective purchasers of the 3M Technical Ceramics product(s) shall comply with all applicable export control laws and regulations, which may require obtaining and maintaining applicable export control authorization or licenses, and understand that the ability of a party to obtain or maintain such authorization or license is not guaranteed. The exporter of record has the sole responsibility to determine whether the export or subsequent reexport of the 3M Technical Ceramics product(s) requires export authorization. An explicit condition to 3M Technical Ceramics selling or making available the 3M Technical Ceramics product(s) is the customer's agreement to comply with all applicable trade compliance laws and regulations.



**3M Technical Ceramics, Inc.**  
3250 S. 614 Road  
Quapaw, OK 74363 USA  
Phone 918-673-2201  
Email boron@mmm.com  
Web www.3M.com/boron

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

Please recycle. Printed in USA © 3M 2020.  
All rights reserved. Issued: 12/20 16586HB  
98-0050-0305-2 Rev. C