Science.
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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 3M boron carbide with specific B to C ratios, enrichments and particle sizes to meet your specifications.

Typical Physical Properties

Characteristic	Composition	Unit
B-10 isotope	>96	at%
B-10 isotope	Report	wt%
Total B	71.7-79.7	wt%
Total C	21.0 - 24.0	wt%
B + C	>97	wt%
Ca	<3,000 (0.3 wt%)	ppm
Fe	<10,000 (1 wt%)	ppm
Fluoride	<25	ppm
Chloride	<75	ppm
Calculation of Soluble B as B203	Report	wt%
Water Soluble B	<0.2	wt%
***Nitric Soluble B**	<0.6	wt%

*Analysis not applicable to Ultrafine, D90 < 5 micron, particle size

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.

*Analysis not applicable to Ultrafine, D90 < 5 micron, particle size

Boron Enrichment Capabilities

3M Technical Ceramics is a leading global commercial processor of enriched boron, and is one of the largest known 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 ^{10}B and ^{11}B enrichment from natural occurring ratios up to levels exceeding 99% isotopic purity. We offer a large supply chain, 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 maintain sophisticated analytical and testing capabilities at our manufacturing facility in Quapaw, OK. Our analytical laboratories support on-site production activities and provide our customers with products that 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 known 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. Make sure you wear the proper PPE when handling this product.

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.

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