

3M Advanced Materials Division

3M™ 10B Enriched Sodium Pentaborate

Introduction

Ceradyne, Inc., a 3M company, manufactures 3M™ 10B Enriched Sodium Pentaborate to meet the needs of boiling water reactor operators. A ruling from the U.S. Nuclear Regulatory Commission requires these operators to upgrade their standby liquid control systems. Enriched boron offers an easy, cost-effective solution that may not require redesign/retrofit of existing facilities or systems. Ceradyne's ability to produce enriched sodium pentaborate customized for each reactor's conditions eliminates the need for costly and confusing mixing of enriched boric acid and natural borax at the reactor site.

More recently, the use of higher fuel enrichments and the popularity of MOX fuels have placed further demands on reactivity controls at boiling water reactor sites. 3M 10B enriched sodium pentaborate provides an excellent solution for these new requirements. Ceradyne has the ability to tailor and produce the exact enriched boron product for each customer's needs. 3M 10B enriched sodium pentaborate and its related products have found application in various areas of the nuclear power industry. We manufacture a standard grade of highly enriched sodium pentaborate for use in most reactor applications where operators wish to blend on site to achieve final enrichment. For those desiring custom enrichments, non-standard materials are available.

Typical Physical Properties

(Not for specification purposes)

Composition	3M™ 10B Enriched Sodium Pentaborate
Form	White Crystals
Formula	$\text{Na}_2\text{O} \cdot 5\text{B}_2\text{O}_3 \cdot 10\text{H}_2\text{O}$
Specific Gravity	1.71 grams/cc(natural)
Boron Content	17.21% @ 99% ¹⁰ B
Thermal (n, ∞) Cross Section (Barns)	3837

Characteristic	Typical Range
Boron Enrichment	96 wt% ¹⁰ B min
Equivalent $\text{Na}_2\text{O} \cdot 5\text{B}_2\text{O}_3 \cdot 10\text{H}_2\text{O}$	99.0 wt% min

Impurities	
Calcium (Ca)	30 ppm max
Chlorine (Cl)	2.0 ppm max
Fluorine (F)	5.0 ppm max
Heavy Metals (Pb)	2.0 ppm max
Iron (Fe)	2.0 ppm max
Phosphates (P)	10.0 ppm max
Sulfates (S)	2.0 ppm max
Water Insolubles	10 ppm max

Solubility in Water

(natural isotopic composition)

Temperature (°C)	% Anhydrous Salt by Weight
0	6.28
10	8.10
20	10.55
30	13.75
40	17.40
50	21.80
60	26.90
70	32.25
80	37.84
90	43.80
100	50.30

Boron Enrichment Capabilities

Ceradyne 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, Ceradyne 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.

Packaging

40 kg per fiber drum, protected by vapor barrier bag. A Certificate of Analysis provided with each shipment. Specific enrichments, purities, and particle sizes are available to meet special requirements.

Product Storage, Handling and Safety

Storage: Keep container tightly closed. See product Safety Data Sheet (SDS) for additional information.

Handling: Do not handle until all safety precautions have been read and understood. Do not breathe dust/fume/gas/mist/vapors/spray. Do not get in eyes, on skin, or on clothing. Do not eat, drink or smoke when using this product. Wash thoroughly after handling. Use personal protective equipment (gloves, respirators, etc.) as required.

See product Safety Data Sheet (SDS) for additional information.

Safety: Handling of this material may be hazardous. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves. See product Safety Data Sheet (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. Emergency shutdown coolant in boiling water reactors.

Refer to SDS for additional information.

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

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



3M Technical Ceramics

Zweigniederlassung der 3M
Deutschland GmbH Max-Schaidhauf-
Str. 25, 87437 Kempten, Germany

Phone +49 (0)831 5618-0
Web www.3M.de/Technical-Ceramics

3M Advanced Materials Division

3M Center
St. Paul, MN 55144 USA

Phone 1-800-367-8905
Web www.3M.com/advancedmaterials

The management system has been certified according to DIN EN ISO 9001, DIN EN ISO 50001, DIN EN ISO 14001.

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

Please recycle. Printed in USA © 3M 2017. All rights reserved. Issued: 10/17 12969HB 98-0050-0309-4