

3M™ Boron Carbide Abrasive Grains and Powders

Introduction

ESK Ceramics GmbH & Co. KG, a 3M company, has been a manufacturer of boron carbide since 1940 and today is one of the world's largest producers of boron carbide products.



3M™ Boron Carbide Grains

3M™ Boron Carbide is a high-performance abrasive with hardness and chemical resistance comparable to that of diamond. Due to its extreme hardness, boron carbide (B_4C) is often known as “black diamond,” and is ideal for rapid machining of hard materials by lapping, sawing or ultrasonic drilling.

3M boron carbide is optimized for consistently high purity and high boron content. It contains almost the exact theoretical boron-to-carbon ratio of 4.3.

Ultrasonic Drilling of Glass, Semi-Precious Stones and Ceramics

Ultrasonic boring is suitable for boring almost any desired profile of hard and brittle materials. As abrasives, 3M boron carbide grains can achieve dimensional stability, contour fidelity and sharp angles at all corners, as well as at the inlet and outlet – all in a single machining operation. At the same time, machining with 3M boron carbide grains delivers outstanding surface quality without altering the structure of the machined surfaces.

Wire Sawing of Ceramics with Boron Carbide

3M boron carbide is harder than aluminum oxide (Al_2O_3), zirconium oxide (ZrO), silicon carbide (SiC) and synthetic sapphire. Due to this exceptional hardness, 3M boron carbide is well suited for wire sawing of oxidic and non-oxidic ceramics, and especially sapphire. When 3M boron carbide is used to saw ceramic materials, the cut surfaces have excellent quality with a planarity of $\pm 5 \mu m$, which makes lapping much easier and more cost effective.

Typical Assay (Not for specification purposes)

Properties	
B	Minimum 76
C	Minimum 19.5
B_2O_3	Maximum 0.5
Fe	Maximum 0.2
O	Maximum 1.0
N	Maximum 1.0
Si	Maximum 0.3

Applications

Lapping

Lapping is the most common final machining method for flat and plane surfaces. 3M boron carbide has a much higher hardness (Mohs 9.5+) than tungsten carbide (WC), titanium carbide (TiC), aluminum oxide (Al_2O_3), zirconium oxide (ZrO) and silicon carbide (SiC). This high hardness allows fast and easy machining of wear-resistant hard metals and ceramics.

FEPA Standard Grain Sizes (Not for specification purposes)

	Grain Designation	Mean Diameter
Macrogrit	F-10	2360 – 1700 μm
	F-20	1180 – 850 μm
	F-40	500 – 355 μm
	F-60	300 – 212 μm
	F-80	212 – 160 μm
	F-100	150 – 106 μm
	F-150	106 – 63 μm
	F-180	90 – 53 μm
	F-220	75 – 45 μm
	Microgrit	F-240
F-280		59 – 22 μm
F-320		49 – 16,5 μm
F-360		40 – 12 μm
F-400		32 – 8 μm
F-500		25 – 5 μm
F-600		19 – 3 μm
F-800		14 – 2 μm
F-1000		10 – 1 μm
F-1200		7 – 1 μm

Non-standard Grain Sizes

Grain Designation	Mean Diameter
1500 F	Approximately 5 µm and finer
3000 F	Approximately 0.8 µm

Additional grain sizes and special grades are available on request.

Delivery Program

3M™ Boron Carbide can be supplied either as grain mixtures or in narrow grain size ranges according to FEPA standards. Grain sizes range from 0.8 µm to over 20 mm.

Storage

3M boron carbide should be stored in a dry place. See product Safety Data Sheet (SDS) for additional information.

About 3M Advanced Ceramics

ESK Ceramics GbH & Co. KG, a 3M company, is one of the world's leading manufacturers of advanced ceramic products and materials for industrial applications. Our extensive range of ceramic materials includes borides (TiB₂, ZrB₂), carbides (SiC, B₄C) and nitrides (SiN, BN). We offer these products in a variety of forms, including functional additives and final articles such as bearings, seal rings, blast nozzles and crucibles.

3M advanced ceramic products are manufactured at fully dedicated, ISO 9001 and 14001 Certified facilities. Our manufacturing processes are optimized for quality, efficiency and consistency – helping ensure reliable and repeatable product performance. We have more than 85 years of experience in designing and manufacturing cutting-edge ceramic solutions, and we continually work to develop new applications for ceramic materials in cooperation with our customers and with research institutions. To learn more about our high-performance ceramic products, contact us at info.esk@mmm.com.

Product is manufactured and sold by ESK Ceramics GmbH & Co. KG, a 3M company.

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

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



ESK Ceramics GmbH & Co. KG,
a 3M company
Max-Schaidhauf-Straße 25
87437 Kempten, Germany
T +49 (0)831 5618-0
F +49 (0)831 5618-345
info.esk@mmm.com

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

Please recycle. Printed in USA.
© 3M 2014. All rights reserved.
Issued: 11/14 10233HB
98-0050-0331-8

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