

3M Advanced Materials Division

3M[™] Boron Nitride Cooling Fillers

Introduction

3M[™] Boron Nitride Cooling Fillers (BNCF) are engineered to help improve thermal conductivity in polymers while maintaining or improving electrical insulation. Their unique properties make these additives beneficial for many thermoplastic, elastomer and thermoset resins used in a wide variety of electrical and electronic applications – including thermal interface materials (TIM), 5G, consumer electronics and automotive applications.

3M Technical Ceramics offers a family of boron nitride cooling filler materials:

- 3M[™] Boron Nitride Cooling Filler Platelets: powders of highly crystalline single platelets
- 3M[™] Boron Nitride Cooling Filler Agglomerates: soft, randomly oriented aggregated platelets
- 3M[™] Boron Nitride Cooling Filler Flakes: hard, oriented aggregated platelets

3M Boron Nitride Cooling Fillers

3M boron nitride cooling fillers are a versatile ceramic material offering thermal conductivity, temperature stability, low loss factor, chemical resistance, high reflectivity, lightweighting and electrical insulation. The structure of layered hexagonal plates provides outstanding lubricating properties and is non-abrasive to tooling.

3M boron nitride 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.

Expertise in Production and Customer Service

With over 50 years of boron nitride manufacturing experience in our German Center of Excellence, our experienced specialists will work with you to optimize your polymer performance. With our broad portfolio offering, 3M engineers will assist you in selecting the correct grade for your application.

For more information, contact us at cpm.technical-ceramics@mmm.com.

Typical Physical Properties

(Not for specification purposes)

0	<0.7%*		
С	<0.2%**		
B ₂ O ₃	<0.1%***		
BN	>98.5%****		

* Platelets CFP 001: O ≤1.2% Platelets CFP 003E and 003SF: O ≤1.1% Platelets CFP 003: O ≤1.0% Platelets CFP 007HS: O ≤0.6% Platelets CFP 006, 0075, 009 and 0012: O ≤0.5% Agglomerates CFA 250S: O ≤10.0%

** all Platelets CFP 001-CFP 012: C ≤0.06 % Platelets CFP 012P: C ≤2.0 %

*** Platelets CFP 001 and 003SF: $B_2 0_3 \le 0.2\%$

**** BN content is calculated as (100% minus B₂O₃, O, C, Si, Al, Fe, Ca, without loss on drying) Platelets CFP 001, 003, 003E and 003SF: BN ≥98.0% Platelets CFP 012P: BN ≥97.0% Agglomerates CFA 250S: BN ≥80.0%, contains an inorganic binder

Note:

- Cooling Filler Platelet (CFP)
- Cooling Filler Flake (CFF)
- Cooling Filler Agglomerate (CFA)

3M[™] Boron Nitride Cooling Fillers – Grade Profiles

3M[™] Boron Nitride Cooling Filler Platelets CFP 003E, 003, 006, 0075, 009 and 012

Optimal all-purpose grades for injection molded and potting resin parts.



SEM micrograph: Grade CFP 0075

3M[™] Boron Nitride Cooling Filler Granulated Platelets CFP 012P

Boron nitride platelets spray-dried with organic binder for better processability (P). Intermediate granulates for high flowability and dosing velocities during feeding that disaggregate during compounding.



SEM micrograph: Grade CFP 012P

3M[™] Boron Nitride Cooling Filler Flakes CFF 500-3 and 200-3

For injection molded and potting resin parts with high through-plane thermal conductivity. Boost thermal conductivity of compounds as secondary filler.



™µm ⊣ SEM micrograph: Grade CFF 500-3

3M[™] Boron Nitride Cooling Filler Platelets CFP 001 and 003SF

Preferred for thin films $<25 \,\mu m$ and fibers, fine channels and windings. 3M CFP 003SF platelets have a controlled top size.



SEM micrograph: Grade CFP 003SF

3M[™] Boron Nitride Cooling Filler Platelets CFP 007HS

ldeal for thin films down to $50 \ \mu m$ due to its controlled top size as well as for injection molded parts and pads with increased in-plane thermal conductivity.



SEM micrograph: Grade CFP 007HS

3M[™] Boron Nitride Cooling Filler Flakes CFF 500-15 and 200-15

For potting resin parts with high through-plane thermal conductivity. Boost thermal conductivity of compounds as secondary filler, preferred for lowest viscosities.



^{100 µm} ├──┤ SEM micrograph: Grade CFF 500-15

3M[™] Boron Nitride Cooling Filler Agglomerates CFA 50M

Mix (M) of agglomerates, platelets and boron nitride clusters. Excellent for potting resins and encapsulation of electronic devices.



¹⁰⁰µm ├──── SEM micrograph: Grade CFA 50M

3M[™] Boron Nitride Cooling Filler Agglomerates CFA 75

Soft agglomerates for high filler loadings and isotropic thermal conductivities. Used in potting resins and conformable TIM foils or pads with thin bond line 100-150µm.



├───┤ SEM micrograph: Grade CFA 75

3M[™] Boron Nitride Cooling Filler Agglomerates CFA 250S

Boron nitride platelets spray-dried with inorganic binder to spherical (S) granulates for high flowability and dosing velocities during feeding. Ideal for TIM pads.



SEM micrograph: Grade CFA 150

3M[™] Boron Nitride Cooling Filler Agglomerates CFA 100

Soft agglomerates for high filler loadings and isotropic thermal conductivities. Best fit for potting resins and conformable TIM foils or pads with thin bond line $150-200 \mu m$.



¹⁰⁰µm ├──── SEM micrograph: Grade CFA 100

3M[™] Boron Nitride Cooling Filler Agglomerates CFA 150

Soft agglomerates for high filler loadings and isotropic thermal conductivities. Used in potting resins and conformable TIM pads with bond line above 200µm.



SEM micrograph: Grade CFA 250S

Powder Characteristics

(Not for specification purposes)

Particle Size Distribution		Bulk Density,	Bulk Density,	Surface Area	Questa		
d(0.1) µm	d(0.5) µm	d(0.9) µm	d(0.97) µm	Scott (g/cm³)	DIN (g/cm ³)	(m²/g)	Grade
n.a.	0.5**	0.8**	-	<0.14	-	<30	Platelets CFP 001
0.5-2.5	1.3-8.8	n.a.***	-	-	<0.3	<15	Platelets CFP 003E
1-2	2–5	8.5-22.5	-	<0.15	-	<18	Platelets CFP 003
0.5-2	2-6	6–14	-	-	<0.15	<20	Platelets CFP 003SF
1.5–3	4.5-8	10-20	-	<0.2	-	<8.5	Platelets CFP 006
1.5–3	5-8	10-20	-	<0.22	-	<13	Platelets CFP 007HS
2-3.5	6-8.5	12-25	-	<0.22	-	<5.5	Platelets CFP 0075
2-3.5	6–12	14-32	-	<0.22	-	<5.5	Platelets CFP 009
2-4.5	8–14	20-40	-	<0.25	-	<4.5	Platelets CFP 012
65-120	125–190	200-300	-	-	0.3-0.55	<3.5	Platelets CFP 012P*
5–10	15–30	35–70	-	-	0.1-0.4	<3.5	Agglomerates CFA 50M*
5–16	25-55	75–115	-	-	0.25-0.4	<3.5	Agglomerates CFA 75*
10-35	50-80	95–145	-	-	0.25-0.4	<3.0	Agglomerates CFA 100*
20-80	120-200	240-360	-	-	0.3-0.55	<3.0	Agglomerates CFA 150*
8–20	40-100	120-210	-	-	0.3-0.6	<4.5	Agglomerates CFA 250S*
140-260	300-530	-	-	-	0.25-0.5	<7.5	Flakes CFF 500-3*
5-120	140-240	-	<450	-	0.3-0.6	<10	Flakes CFF 200-3*
20-150	160-400	-	-	-	0.5-0.7	<3.0	Flakes CFF 500-15*
5-55	65-210	-	<450	-	0.5-0.75	<3.0	Flakes CFF 200-15*

Bulk density determined according to ASTM B329/ISO 3923-2 (Scott density) and according to ISO 23145-2 (DIN density) * Particle size distribution measured by laser light scattering (Mastersizer 2000, dispersion in ethanol)

Particle size distribution measured by laser light scattering (Mastersizer 2000, dry, 0.1 bar)

** Data determined by means of SEM pictures

*** Can include soft agglomerates with 50–100 μm

For calculation purpose: Density of bulk hBN 2.25 g/cm³

Product Storage, Handling and Safety

The substance boron nitride (CAS No. 10043-11-5, EC No. 233-136-6) which comprises the 3M[™] Boron Nitride Cooling Fillers products (all grades) is designated as Active on the TSCA Inventory and complies with all REACH obligations (directives 1907/2006/EC) of manufacturers/importers/ downstream users.

The products contain less than 0.1 wt% Diboron Trioxide, an unavoidable impurity which is a Substance of Very High Concern (SVHC) according to Article 59 of REACH. To the best of 3M's knowledge, 3M[™] Boron Nitride Cooling Fillers products do not contain at greater than 0.1% by weight any other substances on the candidate SVHC list. This declaration reflects the substances on the candidate SVHC list, effective January 2022.

Packaging

3M[™] Boron Nitride Cooling Fillers standard packaging.

Product (Standard drums)	10 kg	20 kg	25 kg
CFP 001	Х		
CFP 003E		Х	
CFP 003		Х	
CFP 003SF	х		
CFP 006		Х	
CFP 007HS		Х	
CFP 0075		Х	
CFP 009		Х	
CFP 012		Х	
CFP 012P			Х
CFF 500-3			Х
CFF 200-3			Х
CFF 500-15			Х
CFF 200-15			Х
CFA 50M			х
CFA 75			Х
CFA 100			Х
CFA 150			Х
CFA 250S			Х

Note: 1 kg samples available

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