GROLLTEX

Safety Data Sheet

According to GHS rev. 5 / Regulation (EC) No 1907/2006 (2015/830)

SECTION 1: Identification of the Substance or Mixture and of the Supplier

1.1 GHS Product Identifier

Product name:	CVD hexagonal Boron Nitride (hBN) film on SiO_2 wafer substrate
Other names:	GrollTex monolayer hBN via CVD
CAS #	Not applicable (mixture)
EC #	Not applicable (mixture)
Index Nº	Not applicable (mixture)
REACH Registration number	Not applicable (see Section 3)
CP C&L inventory	Not applicable (mixture)

1.2 Identified Uses of the Substance and Restrictions on Use

Identified Uses:
Industrial use, research use
Restrictions on Use:
None identified

1.3 Details of the Safety Data Sheet Supplier

GrollTex, Inc.
10085 Scripps Ranch Ct., Suite D
San Diego, CA 92131 USA
Phone: 844 344 6718
Email for SDS: support@grolltex.com

1.4 Emergency Telephone Number

844 344 6718

SECTION 2: Hazards Identification

2.1 GHS Classification of the Substance or Mixture

Not a hazardous substance or mixture.

2.2 GHS Label Elements

Not a hazardous substance or mixture.

2.3 Other Hazards

Physical hazards: Care should be taken to avoid accumulation of boron nitride dust in places where these accumulations could cause disruption of electrical circuits, switches, or components.

SECTION 3: Composition and Information on Ingredients

3.2 Mixtures

Description	hBN film on Copper foil substrate. hBN (CAS 10043-11-5) is an inorganic compound with a flat, hexagonal crystal like that of graphite, but with the carbon atoms replaced by boron and nitrogen atoms. The alternate boron and nitrogen atoms are linked to form interlocking hexagonal rings with three boron atoms and three nitrogen atoms, and the layers are held together by van der Waals forces. It is a two-dimensional allotrope of bulk crystalline boron nitride in the structure of a plane of sp^2 bonded atoms with a molecule bond length of roughly 0.1466 nanometers (1.466 Angstrom). Layers of hBN stacked on top of each other form crystalline boron nitride, with an interplanar spacing of 0.3331 nanometers (3.331 Angstrom). There is no boron-nitrogen bonding between the layers.

Name	CAS #	EC #	N° Reach	Classification (CLP)
h-Boron Nitride	10043-11-5 (bulk powder)	233-136-6	N/A*	Not Classified**
Silicon Dioxide	7631-86-9	231-545-4	N/A*	Not Classified

* Annual tonnage does not require registration or the registration is envisaged for a later registration deadline.

**Please note that substance properties used for the hazard assessment of the mixture come from boron nitride (bulk substance, CAS 10043-11-5). The properties of the nanoform hBN are under evaluation and to some extent not known.

SECTION 4: First Aid Measures

4.1 Description of Necessary Measures

Inhalation	In case of discomfort provide fresh air, warmth and rest, preferably in a comfortable upright sitting position. Rinse nose and mouth with water. Get medical attention if any discomfort continues. If breathing stops, provide artificial respiration.
Ingestion	NEVER make an unconscious person vomit or drink fluids! Rinse nose, mouth and throat with water. Get medical attention if any symptoms develop.
Skin Contact	Wash skin with soap and water. Continue to rinse for at least 15 minutes. Get medical attention if irritation appears after washing.
Eye Contact	Do not rub eye(s). Immediately flush with plenty of water for up to 15-20 minutes. Remove any contact lenses after 5 minutes, maintain open eyes wide apart. Get medical attention promptly if symptoms occur after washing.

4.2 Most Important Symptoms and Effects, Acute and Delayed

Inhalation	May cause irritation to respiratory tract/inhalation.
Ingestion	No effects recorded.
Skin Contact	May cause skin irritation.
Eye Contact	May cause eye irritation.
Delayed Effects	No delayed effects known.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

No data available. Treat as any symptoms arise. Contact a poison control center immediately in case of ingestion or inhalation of large amounts of product. Specific treatment: no specific treatment.

SECTION 5: Firefighting Measures

5.1 Suitable and Unsuitable Extinguishing Media

Suitable extinguishing media: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Always use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2 Special Hazards Arising from the Substance or Mixture

In the event of combustion or thermal decomposition, this material may release nitrogen oxides (NO_x), Borane/boron oxides, and/or other toxic gases.

5.3 Protective Equipment and Precautions for Firefighters

In general, this product is difficult to combust. Normal care should be taken to avoid dust explosion risk caused by high concentrations of dust or finely suspended airborne particles. Use respiratory protective equipment.

SECTION 6: Accidental Release Measures

6.1 Personal Precautions, Protective Equipment, and Emergency Procedures

Prevent dust formation. Emergency responders should wear suitable protective equipment to prevent inhalation or skin contact. In case of spills, beware of slippery floors and surfaces.

6.2 Environmental Precautions

Do not allow to enter drains, sewers or watercourses. The product should not be dumped in nature but collected and delivered according to local regulations.

6.3 Methods and Materials for Containment and Cleaning Up

Spilled or released material should be collected mechanically and disposed of in suitable containers. Prevent dust generation. Clean up any accumulated dust mechanically and dispose of in suitable containers.

SECTION 7: Handling and Storage

7.1 Precautions for Safe Handling

Good laboratory practices should always be used in proximity to this product. Avoid contact with skin and eyes. Wear personal protective equipment to prevent skin and eye contact. Do not wear contact lenses when using this product. Avoid inhalation using local ventilation or appropriate filters. Provide appropriate exhaust ventilation at places where dust if formed. Further processing of solid materials may result in the formation of combustible dusts; potential dust formation should be taken into consideration before processing.

7.2 Conditions for Safe Storage, Including Any Incompatibilities

Store product in cool, dry place in tightly closed containers. Ideally stored under inert atmosphere conditions to promote sample longevity. No special precautions needed.

SECTION 8: Exposure Controls and Personal Protection

8.1 Control Parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure Controls

Engineering Measures
General industrial hygiene practice. Provide adequate ventilation. Observe Occupational Exposure Limits and minimize the risk of inhalation. Provide eyewash station.

8.3 Individual Protection Measures

Protective Equipment


Personal Protective Equipment	
Respiratory Equipment	Respiratory protection must be used if nuisance levels of dusts are generated. If needed, use type N95 (US) or type P1 (EN 143) dust masks A respiratory protection program that meets applicable OHSA (USA) or CEN (UE) requirements should be maintained in the workplace at all times.
Hand Protection	Wear protective gloves.
Eye Protection	Wear approved safety goggles. Use face shield in case of splash risk.
Body Protection	Wear full body industrial type work clothing.
Environmental Exposure Controls	
All ventilation systems should be filtered before discharge to atmosphere. Avoid releasing to the environment. Avoid uncontrolled releases. Inform competent authorities in case large spillage into water courses.	

SECTION 9: Physical and Chemical Properties

9.1 Information of Basic Physical and Chemical Properties

Appearance	One atom thick on SiO_2 wafer (500 µm thick)
Color	Colorless (99% optically transparent)
Odor	Odorless
Initial boiling point and boiling range (ºC)	SiO_2 3265 ºC; hBN not applicable
Melting Point (ºC)	SiO_2 1414 ºC; hBN not applicable
Vapor Density (air = 1)	Not applicable
Vapor Pressure	Not applicable

Evaporation Rate	Not applicable
pH-Value, Conc. Solution	Not applicable
Viscosity (40 ºC)	Not applicable
Bulk Density (20 ºC)	SiO_2 2.650 g/cm^3; hBN 2.29 g/cm^3 at 25 ºC
Solubility Value	Insoluble
Decomposition Temperature (ºC)	-
Flash Point (ºC)	Not applicable
Autoignition Temperature (ºC)	Not applicable
Oxidizing Properties	Not applicable (the mixture is incapable of reacting exothermically with combustible materials based on chemical structure).

9.2 Other Information

No other information required.

SECTION 10: Stability and Reactivity

10.1 Stability

Stable under normal temperature conditions.

10.2 Reactivity

There are no known reactivity hazards associated with this product.

10.3 Possibility of Hazardous Reactions

Not known.

10.4 Conditions to Avoid

Not known.

10.5 Incompatible Materials

Avoid contact with strong oxidizing agents, fluorine, or chlorine trifluoride.

10.6 Hazardous Decomposition Products

Under fire conditions, this material may release carbon monoxide (CO) or carbon dioxide (CO_2) or other toxic gases.

SECTION 11: Toxicological Information

11.1 Information on Toxicological Effects

Absorption, Distribution, and Metabolism	
Absorption	No data available
Distribution	No data available
Potential for Accumulation	No data available
Toxicologically Significant Metabolite	No data available
Acute Toxicity	
Rat LD_{50} Oral	> 2000 mg/kg; rat (BN bulk)
Rat LD_{50} Dermal	> 2000 mg/kg; rat (BN bulk)
Rat LD_{50} Inhalation	> 5.9 mg/l – 4 hr
Skin Irritation	No data available
Eye Irritation	No data available
Skin Sensitization	No data available

Genotoxicity
No data available
Long Term Toxicity and Carcinogenicity
No data available
Reproductive Toxicity
No data available

SECTION 12: Ecological Information

12.1 Ecotoxicity

Bulk BN fish toxicity:
Static test LC_{50} – Oncorhynchus mykiss (rainbow trout) - > 100 mg/l – 96 hr
NOEC – Oncorhynchus mykiss (rainbow trout) - > 100 mg/l

To the best of our knowledge, there is no reliable data suggesting that nanoform hBN should be considered as an environmental hazard.

12.2 Persistence and Degradability

hBN is not biodegradable.

12.3 Bioaccumulative Potential

No data available.

12.4 Mobility in Soil

No data available.

12.6 Other Adverse Effects

No data available.

SECTION 13: Disposal Considerations

13.1 Waste Treatment Methods

General Information	
When handling waste, consideration should be made to the safety precautions applying to handling of the product. Waste should not be disposed of by release to sewers. Uncleaned packagings: Disposal must be made according to official regulations. Cleaned plastic foil substrates may be recycled.	
ECW Code	**Description**
-	-

SECTION 14: Transport Information

14.1 UN Number

Not classified as a dangerous good for transport under ADR, RID, US DOT, IMDG, or ICAO/IATA.

14.2 UN Proper Shipping Name

No information required.

14.3 Transport Hazard Class(es)

No information required.

14.4 Packing Group

No information required.

14.5 Environmental Hazards

No information required.

14.6 Special Precautions for User

No information required.

14.7 Transport in Bulk According to Annex II of Marpol and the IBC Code

No information required.

SECTION 15: Regulatory Information

15.1 Safety, Health, and Environmental Regulations/Legislation Specific for the Substance or Mixture

REACH authorizations: Not required.
REACH Restrictions of use: None.
SVHC list: No
Other U.S. Federal and EPA regulations: The product does not deplete the ozone layer. The product is not a persistent organic pollutant.

Please check your national requirements for nanomaterials.

15.2 Chemical Safety Assessment

No chemical safety assessment has been carried out (substances does not require REACH registration).

SECTION 16: Other Information

Advice on Any Training Appropriate for Workers	To ensure protection of human health and environment, workers must be provided with proper training about how to handle and store chemicals used and contained in their work environment.
SDS Revision Date	4 April 2018

Substituted Version	Not applicable (first version)
Changes to the Previous Version	Not applicable (first version)
Abbreviations and Acronyms	U.S. OSHA GHS Guide Glossary: https://www.osha.gov/dsg/hazcom/ghsguideoct05.pdf European Chemicals Agency (ECHA) glossary: http://echa.cdt.europa.eu/
Key Literature References	U.S. OSHA GHS SDS Guide: https://www.osha.gov/dsg/hazcom/ghsguideoct05.pdf IFA - Databases on hazardous substance (GESTIS): http://limitvalue.ifa.dguv.de/ OSHA Hazard Communication Standard 29 CFR 1910.1200. (FIFRA) Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 et seq.). US EPA Label Review Manual (3rd Edition, August 2003) EPA 735-B-03-001. Federal Hazardous Materials Transportation Law (49 U.S.C. 5101 et seq.).
Note to the Reader	In accordance with Article 31 of the REACH Regulation, this product DOES NOT require a Safety Data Sheet. For this reason and in accordance with the criteria established by the U.S. GHS SDS Guide, it cannot be considered that this document must strictly comply with the provisions of Regulation 2015/830. An SDS is provided for reasons of customer policy compliance.

This information is based on our present state of knowledge and our research into product properties, as well as our research into available scientific literature and information obtained from our vendors. Grolltex Inc. makes no responsibility regarding the accuracy of the scientific literature or any third-party information and, therefore, cannot guarantee any specific material properties.

Use of this information shall not establish a legally binding relationship. The information provided in this SDS must be considered as a starting point for a comprehensive program of health and safety in your company that complies with U.S. Federal standards. If further data on the product is required to perform your risk assessment, please contact us and we will try to assist you as much as possible.