

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

### 1.1 GHS Product Identifier

<b>Product name:</b>	CVD hexagonal Boron Nitride (hBN) film on SiO <sub>2</sub> wafer substrate
<b>Other names:</b>	GrollTex monolayer hBN via CVD
<b>CAS #</b>	10043-11-5 (Boron Nitride)
<b>EC #</b>	Not applicable (mixture)
<b>Index N°</b>	Not applicable (mixture)
<b>REACH Registration number</b>	Not applicable (see Section 3)
<b>CP C&amp;L inventory</b>	Not applicable (mixture)

### 1.2 Identified Uses of the Substance and Restrictions on Use

<b>Identified Uses:</b>
Industrial use, research use
<b>Restrictions on Use:</b>
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: 858 368 9065 Email for SDS: support@grolltex.com
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### 1.4 Emergency Telephone Number

858 368 9065
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**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**

<b>Description</b>	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 <sup>2</sup> 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.
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Name	CAS #	EC #	N° Reach	Classification (CLP)
h-Boron Nitride	10043-11-5 (bulk powder)	233-136-6	N/A*	Not Classified**
Silicon	7440-21-3	231-130-8	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**

<b>Inhalation</b>	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.
<b>Ingestion</b>	NEVER make an unconscious person vomit or drink fluids! Rinse nose, mouth and throat with water. Get medical attention if any symptoms develop.
<b>Skin Contact</b>	Wash skin with soap and water. Continue to rinse for at least 15 minutes. Get medical attention if irritation appears after washing.
<b>Eye Contact</b>	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**

<b>Inhalation</b>	May cause irritation to respiratory tract/inhalation.
<b>Ingestion</b>	No effects recorded.
<b>Skin Contact</b>	May cause skin irritation.
<b>Eye Contact</b>	May cause eye irritation.
<b>Delayed Effects</b>	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<sub>x</sub>), 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 is 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

<b>Protective Equipment</b>


<b>Personal Protective Equipment</b>	
<b>Respiratory Equipment</b>	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 OSHA (USA) or CEN (UE) requirements should be maintained in the workplace at all times.
<b>Hand Protection</b>	Wear protective gloves.
<b>Eye Protection</b>	Wear approved safety goggles. Use face shield in case of splash risk.
<b>Body Protection</b>	Wear full body industrial type work clothing.
<b>Environmental Exposure Controls</b>	
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**

<b>Appearance</b>	One atom thick on SiO <sub>2</sub> wafer (500 µm thick)
<b>Color</b>	Colorless (99% optically transparent)
<b>Odor</b>	Odorless
<b>Initial boiling point and boiling range (°C)</b>	SiO <sub>2</sub> 3265 °C; hBN not applicable
<b>Melting Point (°C)</b>	SiO <sub>2</sub> 1414 °C; hBN not applicable
<b>Vapor Density (air = 1)</b>	Not applicable
<b>Vapor Pressure</b>	Not applicable

<b>Evaporation Rate</b>	Not applicable
<b>pH-Value, Conc. Solution</b>	Not applicable
<b>Viscosity (40 °C)</b>	Not applicable
<b>Bulk Density (20 °C)</b>	SiO <sub>2</sub> 2.650 g/cm <sup>3</sup> ; hBN 2.29 g/cm <sup>3</sup> at 25 °C
<b>Solubility Value</b>	Insoluble
<b>Decomposition Temperature (°C)</b>	-
<b>Flash Point (°C)</b>	Not applicable
<b>Autoignition Temperature (°C)</b>	Not applicable
<b>Oxidizing Properties</b>	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<sub>2</sub>) or other toxic gases.

**SECTION 11: Toxicological Information**

**11.1 Information on Toxicological Effects**

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



<b>Genotoxicity</b>
No data available
<b>Long Term Toxicity and Carcinogenicity</b>
No data available
<b>Reproductive Toxicity</b>
No data available

**SECTION 12: Ecological Information**

**12.1 Ecotoxicity**

Bulk BN fish toxicity:  
 Static test LC<sub>50</sub> – 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.

**12.5 Results of PBT and vPvB Assessment**

The PBT and vPvB criteria of annex XIII to the Regulation do not apply to inorganic substances. Boron Nitride and silicon are inorganic substances. Therefore, PBT and vPvB assessment is not required.

**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
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**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**

# Safety Data Sheet

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

<b>Advice on Any Training Appropriate for Workers</b>	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.
<b>SDS Revision Date</b>	21 February 2020
<b>Substituted Version</b>	Version 2.0
<b>Changes to the Previous Version</b>	Fixed errors in 12.5
<b>Abbreviations and Acronyms</b>	U.S. OSHA GHS Guide Glossary: <a href="https://www.osha.gov/dsg/hazcom/ghsguideoct05.pdf">https://www.osha.gov/dsg/hazcom/ghsguideoct05.pdf</a> European Chemicals Agency (ECHA) glossary: <a href="http://echa.cdt.europa.eu/">http://echa.cdt.europa.eu/</a>
<b>Key Literature References</b>	U.S. OSHA GHS SDS Guide: <a href="https://www.osha.gov/dsg/hazcom/ghsguideoct05.pdf">https://www.osha.gov/dsg/hazcom/ghsguideoct05.pdf</a> IFA - Databases on hazardous substance (GESTIS): <a href="http://limitvalue.ifa.dguv.de/">http://limitvalue.ifa.dguv.de/</a> 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.).
<b>Note to the Reader</b>	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. Grolltex and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product.*

*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.*