MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name	**Boron Nitride Nanotubes (BNNT)**
Version #	02
Issue date	04-29-2013
Revision date	06-21-2014
Supersedes date	-
CAS #	Mixture
MSDS Number	BNNT - 001
Product use	Property Studies; Compositing; Biomedical; Functionalization; Filters; Thermal conductor
Manufacturer information	BNNT, LLC 300 Ed Wright Lane Suite A Newport News VA 23606 US info@bnnt.com http://www.bnnt.com Contact Person: R. Roy Whitney
Emergency	+1 757.369.1939

2. Hazards Identification

Physical state	Solid.
Appearance	The product looks like a ball of cotton or cotton yarn.
OSHA regulatory status	This product is hazardous according to OSHA 29 CFR 1910.1200.
Potential health effects	
Routes of exposure	Inhalation. Ingestion. Skin contact. Eye contact.
Eyes	Dust in the eyes will cause irritation.
Skin	Dust may irritate skin. Research on the dermal exposure of nanomaterials is ongoing.
Inhalation	Dust may irritate the respiratory system.
Ingestion	May cause discomfort if swallowed.
Target organs	Eyes. Skin. Respiratory system. Gastro-intestinal tract.
Chronic effects	Frequent inhalation of dust over a long period of time increases the risk of developing lung diseases.
Signs and symptoms	Causes eye irritation.
Potential environmental effects	The product components are not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

3. Composition / Information on Ingredients

Components	CAS #	Percent
Boron Nitride; (app 50% BNNT, app 50% hexagonal Boron Nitride)	10043-11-5	30-99
Boron	7440-42-8	1-50

Composition comments

* Typical value
All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First Aid Measures

First aid procedures

Eye contact

Dust in the eyes: Do not rub eyes. Immediately flush eye(s) with plenty of water. Remove contact lenses, if present and easy to do. If irritation occurs, get medical assistance.

Skin contact	Contact with dust: Wash area with soap and water. Get medical attention if irritation develops or persists.
Inhalation	Dust irritates the respiratory system, and may cause coughing and difficulties in breathing. If symptomatic, move to fresh air. Get medical attention if discomfort develops or persists.
Ingestion	Rinse mouth thoroughly if dust is ingested. Get medical attention if symptoms occur.
Notes to physician	Provide general supportive measures and treat symptomatically.
General advice	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire Fighting Measures

Flammable properties	The product is non-combustible.
Extinguishing media	
Suitable extinguishing media	Use fire-extinguishing media appropriate for surrounding materials.
Unsuitable extinguishing media	None known.
Protection of firefighters	
Specific hazards arising from the chemical	None known.
Protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire. Selection of respiratory protection for firefighting: follow the general fire precautions indicated in the workplace.
Fire fighting equipment/instructions	Use standard firefighting procedures and consider the hazards of other involved materials.

6. Accidental Release Measures

Personal precautions	Ensure adequate ventilation. Avoid inhalation of dust and contact with skin and eyes. Wear suitable protective clothing. See Section 8 of the MSDS for Personal Protective Equipment.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.
Methods for cleaning up	Avoid dust formation. Collect dust using a vacuum cleaner equipped with HEPA filter.

7. Handling and Storage

Handling	Use work methods which minimize dust production. Local exhaust is recommended. Avoid inhalation of dust and contact with skin and eyes. Wear appropriate personal protective equipment. Wash hands after handling. Observe good industrial hygiene practices.
Storage	Store in tightly closed original container in a well-ventilated place. Read and follow manufacturer's recommendations.

8. Exposure Controls / Personal Protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Engineering controls	Provide sufficient ventilation for operations causing dust formation. ACGIH: OELs (8-hour TLV-TWA) for inhalable dust: 10 mg/m3; respirable dust 3 mg/m3. Observe occupational exposure limits and minimize the risk of exposure. Provide easy access to water supply and eye wash facilities.
Personal protective equipment	
Eye / face protection	Wear dust-resistant safety goggles where there is danger of eye contact.
Skin protection	Wear protective gloves. Wear suitable protective clothing.
Respiratory protection	Use NIOSH/MSHA air purifying respirator if deemed necessary by industrial hygienist.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical & Chemical Properties

Appearance	The product looks like a ball of cotton or cotton yarn.
Physical state	Solid.
Form	Boron Nitride Nanotubes which is a Nanomaterial with at least one dimension of <100 NM (nanometers).

Color	White to light grey.
Odor	Not applicable.
pH	Not applicable.
Vapor pressure	Not applicable.
Vapor density	Not applicable.
Boiling point	Not applicable.
Melting point/Freezing point	5383.4 °F (2973 °C)
Solubility (water)	Insoluble in water.
Specific gravity	2.29
Flash point	Not applicable.
Flammability limit - upper (%) temperature	Not applicable
Flammability limit - lower (%) temperature	Not applicable.
Auto-ignition temperature	Not applicable.
VOC	Not applicable.
Evaporation rate	Not applicable.
Viscosity	Not applicable.
Partition coefficient (n-octanol/water)	Not applicable.
Bulk density	Variable depending on if compacted (UNIT)
Other data	
Decomposition temperature	> 7232 °F (> 4000 °C)

10. Chemical Stability & Reactivity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Avoid dust formation.
Incompatible materials	None known.
Hazardous decomposition products	Boron oxides. Nitrogen compounds.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Toxicological data

Product	**Species**	**Test Results**
Boron Nitride Nanotubes (BNNT) (CAS Mixture)		
Acute		
Dermal		
LD	Rabbit	> 20 ml/kg
Oral		
LD	Rat	> 50 g/kg
Components	**Species**	**Test Results**
Boron (CAS 7440-42-8)		
Acute		
Oral		
LD50	Rat	650 mg/kg

Sensitization	No data available.
Acute effects	May cause discomfort if swallowed. Causes severe eye irritation. May cause respiratory tract irritation.
Local effects	Dusts may irritate the respiratory tract, skin and eyes. May be harmful if swallowed.

Chronic effects	Frequent inhalation of dust over a long period of time increases the risk of developing lung diseases.
Carcinogenicity	No data available.
Mutagenicity	No data available.
Reproductive effects	No data available.
Further information	Information based on BN component of mixture. For BNNT component, acute and chronic toxicity of this substance is not known and is anticipated to be different based on morphology, i.e. few wall long and high wall number short BNNT are anticipated to have different toxicities.

12. Ecological Information

Ecotoxicity	The product is not classified as environmentally hazardous. However, as the BNNT component is a nanomaterial, use of Hazardous Materials Remediation companies are recommended for waste management, and this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability	No data available.
Bioaccumulation / Accumulation	No data available.
Mobility in environmental media	The product is insoluble in water and will sediment in water systems.

13. Disposal Considerations

Disposal instructions	Avoid discharge into water courses or onto the ground. Dispose in accordance with all applicable regulations.
Waste from residues / unused products	Dispose of waste and residues in accordance with local authority requirements.
Contaminated packaging	Dispose of in accordance with local regulations. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport Information

DOT

Not regulated as a hazardous material by DOT.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

TDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations

This product is hazardous according to OSHA 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

CERCLA (Superfund) reportable quantity (lbs) (40 CFR 302.4)

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance (40 CFR 355, Appendix A)	No
Section 311/312 (40 CFR 370)	Yes
Drug Enforcement Administration (DEA) (21 CFR 1308.11-15)	Not controlled
WHMIS status	Non-controlled

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s)

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Not listed.

US - New Jersey RTK - Substances: Listed substance

Boron (CAS 7440-42-8) Listed.

US. Massachusetts RTK - Substance List

Not regulated.

US. New Jersey Worker and Community Right-to-Know Act

Not regulated.

US. Pennsylvania RTK - Hazardous Substances

Not regulated.

16. Other Information

Further information HMIS® is a registered trade and service mark of the NPCA.

HMIS® ratings
Health: 2
Flammability: 0
Physical hazard: 0

NFPA ratings
Health: 2
Flammability: 0
Instability: 0

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