AROVEX™ Nanotube Enhanced Epoxy Resin Carbon Fiber Prepreg

Material Safety Data Sheet

Section I Product and Company Identification

Manufacturer	Zyvex Performance Materials
Address	1255 Kinnear Road, Suite 100, Columbus, Ohio 43212 USA
Telephone	(614) 481-2222
FAX	(614) 481-2260
Emergency	Chemtrec (North America): 800.424.9300 Chemtrec (International): 703.527.3887
Email	safety@zyvexpro.com
Product Name	Functionalized multi-walled carbon nanotubes in epoxy resin on carbon fabric.
Chemical Name	Carbon nanotube (fullerene) functionalized in an epichlorohydrin resin on carbon fabric.
Issue Date	April 8, 2009

Section II Physical/Chemical Characteristics

Appearance	Black tacky fiber
Solubility in water	Negligible
Specific gravity	Not available
Vapor pressure	Not available
Vapor density	Negligible
Evaporation rate	Not available
Boiling point	Not available
Freezing point	Not available

Section III Physical/Chemical Characteristics

Substance	CAS Number	OSHA Permissible Exposure Limit	Carcinogenicity Classification	~ Wt %
Carbon nanotube	7782-42-5	Total Dust: 15 mg/m3 Respirable Fraction: 5 mg/m3 ACGIH TLV: 2 mg/m3	Not listed	≤ 1%
4,4-Isopropylidenediphenol-Epichlorohydrin Copolymer	25068-38-6	None established	Not listed	34≤%
Proprietary Ingredient	Not available	Not available	Not listed	≤ 1%
Carbon fabric/fiber	Not available	Total Dust: 15 mg/m3 Respirable Fraction: 5 mg/m3 ACGIH TLV: 2 mg/m3	Not listed	≤60%
Substituted Urea	17526-94-2		Not listed	≤2%
Cyanoguanidine	461-58-5		Not listed	≤2%

Section IV Fire and Explosion Hazard Data

Flash Point	> 400°F
Explosion Limits	N/A
Extinguishing Media	Use water fog, alcohol foam, dry chemical, or carbon dioxide
Special Fire Fighting Procedures	Do not enter fire area without full bunker gear, including positive pressure MSHA/NIOSH self-contained breathing apparatus. Container areas exposed to direct flame contact should be cooled with large quantities of water as needed to prevent weakening of container structure.
Unusual Fire and Explosion Hazards	Material will not burn unless preheated.

Section V Reactivity Data

Stability	Stable under normal use conditions.
Incompatibility	Can react vigorously with strong oxidizing agents, strong lewis or mineral acid, and strong mineral and organic bases. Avoid contact with water or liquids. Do not allow molten product to contact water or other liquids. This can cause violent eruptions, splatter hot material, or ignite flammable material.
Decomposition	Reaction with some curing agents may produce considerable heat and possible violent decomposition
Hazardous Polymerization	Will not occur.
Conditions to avoid	Avoid high temperatures.

Section VI Health Hazard Data

Toxicity	* Toxicity tests have not been performed on Zyvex Performance Materials products. Treat with caution. Pre-existing skin or lung allergies increase the chance of allergic reaction to exposure.
Eye	May be mildly irritating to eyes. Carbon nanotube toxicity is not known in humans. CNTs were not toxic to rabbit eye in Draize test.
Skin	May cause skin sensitization and/or irritation. Contact with hot material can cause thermal burns which may result in permanent damage. Studies on the effects of dermal contact with carbon nanotubes are limited. Carbon nanotubes did not cause enzyme induction, increased DNA synthesis, or hyperplasia in the skin of allergy-susceptible people.
Ingestion	Not likely to be a relevant route of exposure. Toxicity of carbon nanotubes is unknown.
Inhalation	Not likely to be a relevant route of exposure; however, under conditions where exposure to vapors or mists is possible, could cause respiratory tract. Toxicity of carbon nanotubes is not known in humans. Carbon nanotubes may cause pulmonary irritation, inflammation, granuloma formation, and/or altered pulmonary function in laboratory animals. Inhaled particles may be transported to other area of the body.
Conditions aggravated by exposure	Product should be treated as a hazard. Existing skin and pulmonary diseases may be aggravated by skin or inhalation exposure to carbon nanotubes.

Section VII First Aid Measures

Eye	Flush with large amounts of water for at least 15 minutes, lifting the eyelids to separate them. Do not rub eyes or keep them closed. Seek medical assistance immediately.
Skin	Immediately wash with large amounts of soap and water, remove contaminated clothing, and seek medical assistance if needed. In case of contact with hot product, immediately flood the affected area with cold water. Wipe excess material from exposed area. Flush exposed skin with water and follow by washing with soap if available. Carefully remove clothing; if clothing is stuck to a burn area do not pull it off, but cut around it. Cover burn area with a clean material. Transport to nearest medical facility for additional treatment.
Ingestion	Do not induce vomiting. Have victim rinse out mouth with water, and then drink sips of water to remove taste from mouth. In general, no treatment is necessary unless large quantities of product are ingested. However, get medical advice. Be sure person does not aspirate into lungs. Seek medical assistance immediately.
Inhalation	Remove to fresh air immediately and give oxygen if breathing is difficult. Get medical assistance. If not breathing, give artificial respiration.

Section VIII Precautions for Safe Handling and Use

Material Escape or Spills	Eliminate sources of ignition. Ventilate area. Prevent additional discharge of material, if possible to do so without hazard. For small spills implement cleanup procedures: Dike and contain. Avoid runoff into waterway and ground penetration. Absorb with inert material (i.e., clay or sand) and place into chemical solid waste container. Dispose of properly.
Waste Disposal	Cure resin at 200 ^{o}F until hard and dispose in accordance with applicable laws.
Handling	Use Personal Protective Equipment (see IX) and proper ventilation.
Storage	Store in cool, dark, dry place with adequate ventilation. Keep away from ignition sources and high temperatures.

Section IX Control Measures

Personal Protective Equipment (PPE)	Adequate ventilation should be provided while working with this product. Avoid contact with skin. Protect hands with chemical resistant gloves when handling. Wear lab coat or other protective clothing. Remove and wash contaminated clothing upon exposure. Wear chemical safety goggles and full face shield if splashing is possible.
Chemical Hygiene	Wash hands after handling material to minimize the spread of undetected skin contamination. All applicable laboratory safety guidelines should be followed when using this material.

Section X Transportation Measures

DOT Proper Shipping Name	NOT REGULATED FOR TRANSPORT
DOT Hazard Class	NOT REGULATED FOR TRANSPORT
Identification Number	NOT REGULATED FOR TRANSPORT
Packaging Group	NOT REGULATED FOR TRANSPORT

Section XI Special Precautions

This information is provided for in good faith and is believed to be correct. Zyvex Performance Materials; however, makes no representation as to the comprehensiveness or accuracy of this information. Final determination of the suitability of this product and its safe use is the sole responsibility of the user. Accordingly, Zyvex Performance Materials will not be responsible for damages of any kind resulting from the use of or reliance upon the provided information.

AROVEX™ Nanotube Enhanced Epoxy Resin Carbon Fiber Unidirectional Tape Prepreg

Material Safety Data Sheet

Section I Product and Company Identification

Manufacturer	Zyvex Performance Materials
Address	1255 Kinnear Road, Suite 100, Columbus, Ohio 43212 USA
Telephone	(614) 481-2222
FAX	(614) 481-2260
Emergency	Chemtrec (North America): 800.424.9300 Chemtrec (International): 703.527.3887
Email	safety@zyvexpro.com
Product Name	Functionalized multi-walled carbon nanotubes in epoxy resin on carbon fabric.
Chemical Name	Carbon nanotube (fullerene) functionalized in an epichlorohydrin resin on carbon fabric.
Issue Date	April 8, 2009

Section II Physical/Chemical Characteristics

Appearance	Black tacky tape
Solubility in water	Negligible
Specific gravity	Not available
Vapor pressure	Not available
Vapor density	Negligible
Evaporation rate	Not available
Boiling point	Not available
Freezing point	Not available

Section III Physical/Chemical Characteristics

Substance	CAS Number	OSHA Permissible Exposure Limit	Carcinogenicity Classification	~ Wt %
Carbon nanotube	7782-42-5	Total Dust: 15 mg/m3 Respirable Fraction: 5 mg/m3 ACGIH TLV: 2 mg/m3	Not listed	≤ 1%
4,4-Isopropylidenediphenol-Epichlorohydrin Copolymer	25068-38-6	None established	Not listed	34≤%
Proprietary Ingredient	Not available	Not available	Not listed	≤ 1%
Carbon fabric/fiber	Not available	Total Dust: 15 mg/m3 Respirable Fraction: 5 mg/m3 ACGIH TLV: 2 mg/m3	Not listed	≤60%
Substituted Urea	17526-94-2		Not listed	≤2%
Cyanoguanidine	461-58-5		Not listed	≤2%

Section IV Fire and Explosion Hazard Data

Flash Point	> 400°F
Explosion Limits	N/A
Extinguishing Media	Use water fog, alcohol foam, dry chemical, or carbon dioxide
Special Fire Fighting Procedures	Do not enter fire area without full bunker gear, including positive pressure MSHA/NIOSH self-contained breathing apparatus. Container areas exposed to direct flame contact should be cooled with large quantities of water as needed to prevent weakening of container structure.
Unusual Fire and Explosion Hazards	Material will not burn unless preheated.

Section V Reactivity Data

Stability	Stable under normal use conditions.
Incompatibility	Can react vigorously with strong oxidizing agents, strong lewis or mineral acid, and strong mineral and organic bases. Avoid contact with water or liquids. Do not allow molten product to contact water or other liquids. This can cause violent eruptions, splatter hot material, or ignite flammable material.
Decomposition	Reaction with some curing agents may produce considerable heat and possible violent decomposition
Hazardous Polymerization	Will not occur.
Conditions to avoid	Avoid high temperatures.

Section VI Health Hazard Data

Toxicity	* Toxicity tests have not been performed on Zyvex Performance Materials products. Treat with caution. Pre-existing skin or lung allergies increase the chance of allergic reaction to exposure.
Eye	May be mildly irritating to eyes. Carbon nanotube toxicity is not known in humans. CNTs were not toxic to rabbit eye in Draize test.
Skin	May cause skin sensitization and/or irritation. Contact with hot material can cause thermal burns which may result in permanent damage. Studies on the effects of dermal contact with carbon nanotubes are limited. Carbon nanotubes did not cause enzyme induction, increased DNA synthesis, or hyperplasia in the skin of allergy-susceptible people.
Ingestion	Not likely to be a relevant route of exposure. Toxicity of carbon nanotubes is unknown.
Inhalation	Not likely to be a relevant route of exposure; however, under conditions where exposure to vapors or mists is possible, could cause respiratory tract. Toxicity of carbon nanotubes is not known in humans. Carbon nanotubes may cause pulmonary irritation, inflammation, granuloma formation, and/or altered pulmonary function in laboratory animals. Inhaled particles may be transported to other area of the body.
Conditions aggravated by exposure	Product should be treated as a hazard. Existing skin and pulmonary diseases may be aggravated by skin or inhalation exposure to carbon nanotubes.

Section VII First Aid Measures

Eye	Flush with large amounts of water for at least 15 minutes, lifting the eyelids to separate them. Do not rub eyes or keep them closed. Seek medical assistance immediately.
Skin	Immediately wash with large amounts of soap and water, remove contaminated clothing, and seek medical assistance if needed. In case of contact with hot product, immediately flood the affected area with cold water. Wipe excess material from exposed area. Flush exposed skin with water and follow by washing with soap if available. Carefully remove clothing; if clothing is stuck to a burn area do not pull it off, but cut around it. Cover burn area with a clean material. Transport to nearest medical facility for additional treatment.
Ingestion	Do not induce vomiting. Have victim rinse out mouth with water, and then drink sips of water to remove taste from mouth. In general, no treatment is necessary unless large quantities of product are ingested. However, get medical advice. Be sure person does not aspirate into lungs. Seek medical assistance immediately.
Inhalation	Remove to fresh air immediately and give oxygen if breathing is difficult. Get medical assistance. If not breathing, give artificial respiration.

Section VIII Precautions for Safe Handling and Use

Material Escape or Spills	Eliminate sources of ignition. Ventilate area. Prevent additional discharge of material, if possible to do so without hazard. For small spills implement cleanup procedures: Dike and contain. Avoid runoff into waterway and ground penetration. Absorb with inert material (i.e., clay or sand) and place into chemical solid waste container. Dispose of properly.
Waste Disposal	Cure resin at 200 ^{o}F until hard and dispose in accordance with applicable laws.
Handling	Use Personal Protective Equipment (see IX) and proper ventilation.
Storage	Store in cool, dark, dry place with adequate ventilation. Keep away from ignition sources and high temperatures.

Section IX Control Measures

Personal Protective Equipment (PPE)	Adequate ventilation should be provided while working with this product. Avoid contact with skin. Protect hands with chemical resistant gloves when handling. Wear lab coat or other protective clothing. Remove and wash contaminated clothing upon exposure. Wear chemical safety goggles and full face shield if splashing is possible.
Chemical Hygiene	Wash hands after handling material to minimize the spread of undetected skin contamination. All applicable laboratory safety guidelines should be followed when using this material.

Section X Transportation Measures

DOT Proper Shipping Name	NOT REGULATED FOR TRANSPORT
DOT Hazard Class	NOT REGULATED FOR TRANSPORT
Identification Number	NOT REGULATED FOR TRANSPORT
Packaging Group	NOT REGULATED FOR TRANSPORT

Section XI Special Precautions

This information is provided for in good faith and is believed to be correct. Zyvex Performance Materials; however, makes no representation as to the comprehensiveness or accuracy of this information. Final determination of the suitability of this product and its safe use is the sole responsibility of the user. Accordingly, Zyvex Performance Materials will not be responsible for damages of any kind resulting from the use of or reliance upon the provided information.