

SAFETY DATA SHEET

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SECTION 1. IDENTIFICATION

Product Name: Aluminum Nitride Nanoparticle Dispersion

Product Number: All applicable American Elements product codes, e.g. AL-N-01-NPD

CAS #: 24304-00-5

Relevant identified uses of the substance: Scientific research and development

Supplier details:

American Elements 10884 Weyburn Ave. Los Angeles, CA 90024 Tel: +1 310-208-0551 Fax: +1 310-208-0351

Emergency telephone number: +1 800-424-9300

SECTION 2. HAZARDS IDENTIFICATION

Classification of the substance or mixture in accordance with 29 CFR 1910 (OSHA HCS) GHS07

Skin Irrit. 2 H315 Causes skin irritation.

Eye Irrit. 2A H319 Causes serious eye irritation.

STOT SE 3 H335 May cause respiratory irritation.

Hazards not otherwise classified No data available.

GHS label elements The product is classified and labeled in accordance with 29 CFR 1910 (OSHA HCS)

Hazard pictograms



GHS07 Signal word Warning Hazard statements H315 Causes skin irritation. H319 Causes serious eye irritation. H335 May cause respiratory irritation. Precautionary statements P261 Avoid breathing dust/fume/gas/mist/vapors/spray.

P280 Wear protective gloves/protective clothing/eye protection/face protection. P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing. P405 Store locked up. P501 Dispose of contents/container in accordance with local/regional/national/international regulations. WHMIS classification D2B - Toxic material causing other toxic effects Classification system HMIS ratings (scale 0-4) (Hazardous Materials Identification System) HEALTH FIRE REACTIVITY 1 0 1 Health (acute effects) = 1Flammability = 0Physical Hazard = 1 Other hazards Results of PBT and vPvB assessment: PBT: N/A. vPvB: N/A.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances CAS No. / Substance Name: 24304-00-5 Aluminium nitride Identification number(s): EC number: 246-140-8

SECTION 4. FIRST AID MEASURES

Description of first aid measures If inhaled: Supply fresh air. If not breathing, provide artificial respiration. Keep patient warm. Seek immediate medical advice. In case of skin contact: Immediately wash with soap and water; rinse thoroughly. Seek immediate medical advice. In case of eye contact: Rinse opened eye for several minutes under running water. Consult a physician. If swallowed: Seek medical treatment. Information for doctor Most important symptoms and effects, both acute and delayed No information available. Indication of any immediate medical attention and special treatment needed No information available.

SECTION 5. FIREFIGHTING MEASURES

Extinguishing media Suitable extinguishing media In case of fire, use sand, carbon dioxide or powdered extinguishing agent. Never use water. For safety reasons unsuitable extinguishing media Water Special hazards arising from the substance or mixture If this product is involved in a fire, the following can be released: Nitrogen oxides (NOx) Metal oxide fume Ammonia Advice for firefighters Protective equipment: Wear self-contained respirator. Wear fully protective impervious suit.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures Wear protective equipment. Keep unprotected persons away. Ensure adequate ventilation Environmental precautions: Do not allow product to reach sewage system or any water course. Methods and material for containment and cleanup: Pick up mechanically. Prevention of secondary hazards: No special measures required. Reference to other sections See Section 7 for information on safe handling See Section 8 for information on personal protection equipment. See Section 13 for disposal information.

SECTION 7. HANDLING AND STORAGE

Handling Precautions for safe handling Handle under dry protective gas. Keep container tightly sealed. Store in cool, dry place in tightly closed containers. Ensure adequate ventilation. Information about protection against explosions and fires: No data available. Conditions for safe storage, including any incompatibilities Storage Requirements to be met by storerooms and receptacles: No special requirements. Information about storage in one common storage facility: Store away from water/moisture. Do not store together with acids. Store away from strong bases. Store away from oxidizing agents. Further information about storage conditions: Store under dry inert gas. This product is moisture sensitive. Keep container tightly sealed.

Store in cool, dry conditions in well-sealed containers. Protect from humidity and water. Specific end use(s) No information available.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Additional information about design of technical systems: Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute. **Control parameters** Components with limit values that require monitoring at the workplace: 24304-00-5 Aluminium nitride (100.0%) REL (USA) Long-term value: 2 mg/m³ as Al TLV (USA) Long-term value: 1* mg/m³ as Al;*as respirable fraction EL (Canada) Long-term value: 2 mg/m³ as Al Additional information: No data Exposure controls Personal protective equipment Follow typical general protective and industrial hygiene measures for handling chemicals. Keep away from foodstuffs, beverages and feed. Remove all soiled and contaminated clothing immediately. Wash hands before breaks and at the end of work. Avoid contact with the eyes and skin. Breathing equipment: Use suitable respirator when high concentrations are present. Recommended filter device for short term use: Use a respirator with type N95 (USA) or PE (EN 143) cartridges as a backup to engineering controls. Risk assessment should be performed to determine if airpurifying respirators are appropriate. Only use equipment tested and approved under appropriate government standards. Protection of hands: Impervious gloves Inspect gloves prior to use. The selection of suitable gloves not only depends on the material, but also on quality. Quality will vary from manufacturer to manufacturer. Material of gloves Nitrile rubber, NBR Penetration time of glove material (in minutes) No data available. Eye protection: Safety glasses Body protection: Protective work clothing.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties Appearance: Form: Powder Color: White Odor: Ammonia-like Odor threshold: No data available. pH: N/A. Melting point/range: >2200 °C (>3992 °F) Boiling point/range: No data available. Sublimation temperature / start: No data available. Flammability (solid, gas): No data available. Ignition temperature: No data available. Decomposition temperature: ca 977 °C (ca 1791 °F) Auto igniting: No data available. Danger of explosion: No data available. Explosion limits: Lower: No data available. Upper: No data available. Vapor pressure: N/A. Density at 20 °C (68 °F): 3.26 g/cm³ (27.205 lbs/gal) Relative density No data available. Vapor density N/A. Evaporation rate N/A. Solubility in / Miscibility with Water: Hydrolyzes slowly Partition coefficient (n-octanol/water): No data available. Viscosity: Dynamic: N/A. Kinematic: N/A. Other information No information available.

SECTION 10. STABILITY AND REACTIVITY

Reactivity No data available. Chemical stability Stable under recommended storage conditions. Thermal decomposition / conditions to be avoided: Decomposition will not occur if used and stored according to specifications. Possibility of hazardous reactions Reacts with strong oxidizing agents Conditions to avoid No information available. Incompatible materials: Acids Water/moisture Bases Oxidizing agents Hazardous decomposition products: Nitrogen oxides Ammonia Metal oxide fume

SECTION 11. TOXICOLOGICAL INFORMATION

Information on toxicological effects

Acute toxicity: The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute toxicity data for this substance.

LD/LC50 values that are relevant for classification: No data

Skin irritation or corrosion: Causes skin irritation.

Eye irritation or corrosion: Causes serious eye irritation.

Sensitization: No sensitizing effects known.

Germ cell mutagenicity: N/A Carcinogenicity: ACGIH A4: Not classifiable as a human carcinogen: Inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals. Reproductive toxicity: N/A Specific target organ system toxicity - repeated exposure: N/A Specific target organ system toxicity - single exposure: May cause respiratory irritation. Aspiration hazard: N/A Subacute to chronic toxicity: N/A Additional toxicological information: To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.

SECTION 12. ECOLOGICAL INFORMATION

Toxicity

Aquatic toxicity: No information available. Persistence and degradability: No information available. Bioaccumulative potential: No information available. Mobility in soil: No information available. Additional ecological information: General notes: Do not allow undiluted product or large quantities to reach ground water, water course or sewage system. Avoid transfer into the environment. Results of PBT and vPvB assessment: PBT: N/A. vPvB: N/A. Other adverse effects No information available.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste treatment methods Recommendation: Consult state, local or national regulations to ensure proper disposal. Uncleaned packagings: Recommendation: Disposal must be made according to official regulations.

SECTION 14. TRANSPORT INFORMATION

UN-Number DOT, ADN, IMDG, IATA N/A UN proper shipping name DOT, ADN, IMDG, IATA N/A Transport hazard class(es) DOT, ADR, ADN, IMDG, IATA Class N/A Packing group DOT, IMDG, IATA N/A Environmental hazards: N/A. Special precautions for user N/A. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code N/A.

SECTION 15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture GHS label elements The product is classified and labeled in accordance with 29 CFR 1910 (OSHA HCS) Hazard pictograms GHS07 Signal word Warning Hazard statements H315 Causes skin irritation. H319 Causes serious eye irritation. H335 May cause respiratory irritation. Precautionary statements P261 Avoid breathing dust/fume/gas/mist/vapors/spray. P280 Wear protective gloves/protective clothing/eye protection/face protection. P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing. P405 Store locked up. P501 Dispose of contents/container in accordance with local/regional/national/international regulations. National regulations All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory. All components of this product are listed on the Canadian Domestic Substances List (DSL). SARA Section 313 (specific toxic chemical listings) Substance is not listed. California Proposition 65 Prop 65 - Chemicals known to cause cancer Substance is not listed. Prop 65 - Developmental toxicity Substance is not listed. Prop 65 - Developmental toxicity, female Substance is not listed. Prop 65 - Developmental toxicity, male Substance is not listed. Information about limitation of use: For use only by technically qualified individuals. Other regulations, limitations and prohibitive regulations Substance of Very High Concern (SVHC) according to the REACH Regulations (EC) No. 1907/2006. Substance is not listed. The conditions of restrictions according to Article 67 and Annex XVII of the Regulation (EC) No 1907/2006 (REACH) for the manufacturing, placing on the market and use must be observed. Substance is not listed. Annex XIV of the REACH Regulations (requiring Authorisation for use) Substance is not listed. Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

SECTION 2. HAZARDS IDENTIFICATION

Classification of the substance or mixture Classification according to Regulation (EC) No 1272/2008 GHS02 Flame Flam. Lig. 2 H225 Highly flammable liquid and vapor. GHS08 Health hazard STOT SE 2 H371 May cause damage to organs. Classification according to Directive 67/548/EEC or Directive 1999/45/EC Xn; Harmful R20/21/22-68/20/21/22: Harmful by inhalation, in contact with skin and if swallowed. Harmful:possible risk of irreversible effects through inhalation, in contact with skin and if swallowed. F; Highly flammable R11: Highly flammable. Information concerning particular hazards for human and environment: Not applicable Hazards not otherwise classified No information known. Label elements Labelling according to Regulation (EC) No 1272/2008 The product is classified and labeled according to the CLP regulation. Hazard pictograms



GHS02 GHS08 Signal word: Danger Hazard-determining components of labeling: Methanol Hazard statements H225 Highly flammable liquid and vapor. H371 May cause damage to organs. Precautionary statements P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking. P260 Do not breathe dust/fume/gas/mist/vapours/spray. P280 Wear protective gloves/protective clothing/eye protection/face protection. P303+P361+P353 If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. P405 Store locked up. P501 Dispose of contents/container in accordance with local/regional/national/international regulations. WHMIS classification B2 - Flammable liquid D2B - Toxic material causing other toxic effects Classification system HMIS ratings (scale 0-4) (Hazardous Materials Identification System) Health (acute effects) = 2Flammability = 3Physical Hazard = 1 Other hazards Results of PBT and vPvB assessment PBT: Not applicable. vPvB: Not applicable.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical characterization: Substances CAS# Description: Dangerous components: 64-17-5 Ethyl alcohol - 99% 24304-00-5 Aluminum Nitride

SECTION 4. FIRST AID MEASURES

Description of first aid measures After inhalation Supply fresh air. If required, provide artificial respiration. Keep patient warm. Seek immediate medical advice. After skin contact Immediately wash with water and soap and rinse thoroughly. Seek immediate medical advice. After eve contact Rinse opened eye for several minutes under running water. Then consult a doctor. After swallowing Seek medical treatment. Information for doctor Most important symptoms and effects, both acute and delayed No further relevant information available. Indication of any immediate medical attention and special treatment needed No further relevant information available.

SECTION 5. FIREFIGHTING MEASURES

Extinguishing media Suitable extinguishing agents Carbon dioxide, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam. Special hazards arising from the substance or mixture If this product is involved in a fire, the following can be released: Carbon monoxide and carbon dioxide Advice for firefighters Protective equipment: Wear self-contained respirator. Wear fully protective impervious suit.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures Wear protective equipment. Keep unprotected persons away. Ensure adequate ventilation Keep away from ignition sources Environmental precautions: Do not allow material to be released to the environment without proper governmental permits.

Do not allow product to reach sewage system or any water course.

Do not allow to penetrate the ground/soil. Methods and material for containment and cleaning up: Keep away from ignition sources. Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust). Dispose of contaminated material as waste according to section 13. Ensure adequate ventilation. Prevention of secondary hazards: Keep away from ignition sources. Reference to other sections See Section 7 for information on safe handling See Section 8 for information on personal protection equipment. See Section 13 for disposal information.

SECTION 7. HANDLING AND STORAGE

Handling

Precautions for safe handling

Keep container tightly sealed.

Store in cool, dry place in tightly closed containers.

Ensure good ventilation at the workplace.

Information about protection against explosions and fires:

Protect against electrostatic charges.

Fumes can combine with air to form an explosive mixture.

Keep ignition sources away.

Conditions for safe storage, including any incompatibilities Storage

Requirements to be met by storerooms and receptacles:

Store in a cool location.

Information about storage in one common storage facility:

Store away from oxidizing agents.

Store away from water/moisture.

Further information about storage conditions:

This product is hygroscopic.

Store under dry inert gas.

Keep container tightly sealed.

Store in cool, dry conditions in well sealed containers.

Protect from humidity and water.

Specific end use(s)

No further relevant information available.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Additional information about design of technical systems: Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute. Control parameters Components with limit values that require monitoring at the workplace: 64-17-5 Ethyl alcohol (99.0%) PEL (USA) Long-term value: 1900 mg/m³, 1000 ppm REL (USA) Long-term value: 1900 mg/m³, 1000 ppm TLV (USA) Short-term value: 1880 mg/m³, 1000 ppm EV (Canada) Long-term value: 1.900 mg/m³, 1.000 ppm Additional information: No data Exposure controls Personal protective equipment General protective and hygienic measures The usual precautionary measures for handling chemicals should be followed. Keep away from foodstuffs, beverages and feed. Remove all soiled and contaminated clothing immediately. Wash hands before breaks and at the end of work. Do not inhale dust / smoke / mist. Avoid contact with the eyes and skin. Maintain an ergonomically appropriate working environment. Breathing equipment: Use self-contained breathing apparatus (SCBA) as a backup to engineering controls. Risk assessment should be performed. Only use equipment tested and approved under appropriate government standards such as NIOSH (USA) or CEN (EU). Protection of hands: Impervious gloves Check protective gloves prior to each use for their proper condition. The selection of suitable gloves not only depends on the material, but also on quality. Quality will vary from manufacturer to manufacturer. Material of gloves Butyl rubber, BR Penetration time of glove material (in minutes) Not determined Eve protection: Safety glasses Body protection: Protective work clothing.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties **General Information** Appearance: Form: Liquid Color: Colorless Odor: Alcohol-like Odor threshold: Not determined. pH-value: Not determined. Change in condition Melting point/Melting range: -90 °C (-130 °F) Boiling point/Boiling range: 78 °C (172 °F) Sublimation temperature / start: Not determined Flash point: 11 °C (52 °F) Flammability (solid, gaseous): Not applicable. Ignition temperature: 455 °C (851 °F) Decomposition temperature: Not determined Auto igniting: Product is not selfigniting.

Danger of explosion: Product is not explosive. However, formation of explosive air/vapor mixtures is possible. Explosion limits: Lower: 3.5 Vol % Upper: 15.0 Vol % Vapor pressure at 20 °C (68 °F): 57 hPa (43 mm Hg) Density at 20 °C (68 °F): 0.789 g/cm³ (6.584 lbs/gal) Relative density: Not determined. Vapor density: Not determined. Evaporation rate: Not determined. Solubility in / Miscibility with Water: Fully miscible Partition coefficient (n-octanol/water): Not determined. Viscositv: dynamic: Not determined. kinematic: Not determined. Solvent content: Organic solvents: 10.0 % Other information No further relevant information available.

SECTION 10. STABILITY AND REACTIVITY

Reactivity No information known. Chemical stability Stable under recommended storage conditions. Thermal decomposition / conditions to be avoided: Decomposition will not occur if used and stored according to specifications. Possibility of hazardous reactions No dangerous reactions known Conditions to avoid No further relevant information available. Incompatible materials: Oxidizing agents Water/moisture Hazardous decomposition products: Carbon monoxide and carbon dioxide

SECTION 11. TOXICOLOGICAL INFORMATION

Information on toxicological effects Acute toxicity: Harmful if inhaled. Harmful in contact with skin. Harmful if swallowed. Danger through skin absorption. The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute toxicity data for components in this product. LD/LC50 values that are relevant for classification: 64-17-5 Ethyl alcohol Oral LD50 7060 mg/kg (rat) Skin irritation or corrosion: May cause irritation

Eye irritation or corrosion: May cause irritation

Sensitization: No sensitizing effects known.

Germ cell mutagenicity:

The Registry of Toxic Effects of Chemical Substances (RTECS) contains mutation data for components in this product.

Carcinogenicity:

ACGIH A3: Animal carcinogen: Agent is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) not considered relevant to worker exposure. Available epidemologic studies do not confirm an increased risk of cancer in exposed humans.

Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.

IARC-3: Not classifiable as to carcinogenicity to humans.

ACGIH A4: Not classifiable as a human carcinogen: Inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals.

The Registry of Toxic Effects of Chemical Substances (RTECS) contains tumorigenic and/or carc inogenic and/or neoplastic data for components in this product.

Reproductive toxicity:

The Registry of Toxic Effects of Chemical Substances (RTECS) contains reproductive data for components in this product.

Specific target organ system toxicity - repeated exposure: No effects known.

Specific target organ system toxicity - single exposure: May cause damage to organs.

Aspiration hazard: No effects known.

Subacute to chronic toxicity:

The Registry of Toxic Effects of Chemical Substances (RTECS) contains multiple dose toxicity data for this substance.

Additional toxicological information:

To the best of our knowledge the acute and chronic toxicity of this substance is not fully known. The product shows the following dangers according to internally approved calculation methods for preparations: Harmful

SECTION 12. ECOLOGICAL INFORMATION

Toxicity

Aquatic toxicity:

No further relevant information available.

Persistence and degradability

No further relevant information available.

Bioaccumulative potential

No further relevant information available.

Mobility in soil

No further relevant information available.

Additional ecological information:

General notes:

Do not allow material to be released to the environment without proper governmental permits. Do not allow undiluted product or large quantities to reach ground water, water course or sewage system.

Avoid transfer into the environment. Results of PBT and vPvB assessment PBT: Not applicable. vPvB: Not applicable. Other adverse effects

SECTION 13. DISPOSAL CONSIDERATIONS

Waste treatment methods Recommendation Consult state, local or national regulations to ensure proper disposal. Uncleaned packagings: Recommendation: Disposal must be made according to official regulations. Recommended cleansing agent: Water, if necessary with cleansing agents.

SECTION 14. TRANSPORT INFORMATION

UN-Number DOT, IMDG, IATA UN1987 UN proper shipping name DOT Alcohols, n.o.s. IMDG, IATA ALCOHOLS, N.O.S. Transport hazard class(es) DOT Class 3 Flammable liquids. Label 3 Class 3 (F1) Flammable liquids Label 3 IMDG, IATA Class 3 Flammable liquids. Label 3 Packing group DOT, IMDG, IATA Ш Environmental hazards: Marine pollutant (IMDG): No Special precautions for user Warning: Flammable liquids EMS Number: F-E,S-D Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code Not applicable. Transport/Additional information:

SECTION 15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture National regulations All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory. All components of this product are listed on the Canadian Domestic Substances List (DSL). SARA Section 313 (specific toxic chemical listings) 24304-00-5 Aluminum Nitride 64-17-5 Ethanol 5.0% California Proposition 65 Prop 65 - Chemicals known to cause cancer None of the ingredients are listed. Prop 65 - Developmental toxicity 24304-00-5 Aluminum Nitride 64-17-5 Ethanol 5.0% Prop 65 - Developmental toxicity, female None of the ingredients are listed. Prop 65 - Developmental toxicity, male None of the ingredients are listed. Information about limitation of use: For use only by technically qualified individuals. Other regulations, limitations and prohibitive regulations Substance of Very High Concern (SVHC) according to the REACH Regulations (EC) No. 1907/2006. None of the ingredients are listed. The conditions of restrictions according to Article 67 and Annex XVII of the Regulation (EC) No 1907/2006 (REACH) for the manufacturing, placing on the market and use must be observed. None of the ingredients is listed. Annex XIV of the REACH Regulations (requiring Authorisation for use) None of the ingredients is listed. **REACH - Pre-registered substances** 24304-00-5 Aluminum Nitride Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

SECTION 16. OTHER INFORMATION

Safety Data Sheet according to Regulation (EC) No. 1907/2006 (REACH). The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. American Elements shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for

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