

Safety Data Sheet (SDS)
V2V Solvent Dispersion
Single-wall Carbon Nanotube Ink



SECTION 1 PRODUCT IDENTIFICATION

PRODUCT NAME: Single-wall Carbon Nanotube Ink VC101¹ Solvent Dispersion, V2V

OTHER/GENERIC NAMES: V2V Ink, SWCNT Ink, Single-Wall Carbon Nanotube Ink

MANUFACTURER: Chasm Advanced Materials, Inc.
480 Neponset Street, Bldg. 6
Canton, MA 02021 USA
Tel: +1.781.821.0443
Fax: +1.781.821.0447
www.chasmtek.com
safety@chasmtek.com

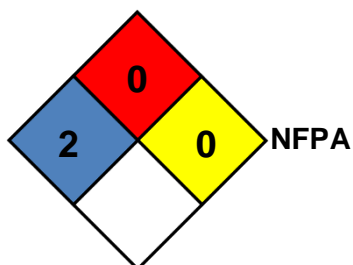
EMERGENCY PHONE: +1.339.502.0440

PRODUCT USE: One or more components in this material have been approved for specific commercial uses under a US EPA TSCA Consent Order, apart from its non-restricted R&D use. Refer to section 15 for approved commercial uses and limitations/restrictions on its use.

¹ This ink is based on V2V™ Technology from Chasm Technologies, Inc. Patents Pending

SECTION 2 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Product is an organic dispersion. May cause eye, skin and respiratory tract burns and irritation. Contains carbon nanomaterial, the complete physical and toxicological properties of which have not been fully evaluated.



Health Hazard	②	HMIS
Fire Hazard	①	
Reactivity	①	

OSHA HAZARDS: Flammable material. Toxic by ingestion. Toxic by inhalation. Toxic by skin absorption. Corrosive. Target organ effect.

TARGET ORGANS: Gastrointestinal tract, Liver, Cardiovascular system, Kidney, Nerves.

GHS CLASSIFICATION: Skin irritation (Category 3)
Serious eye damage (Category 1)
Acute aquatic toxicity (Category 3)
Chronic aquatic toxicity (Category 3)

GHS LABEL ELEMENTS

PICTOGRAMS

SIGNAL WORD



HAZARD STATEMENT(S)

H225	Highly flammable liquid and vapor
H301	Toxic in swallowed
H311	Toxic in contact with skin
H314	Causes severe skin burns and eye damage
H331	Toxic if inhaled
H412	Very toxic to aquatic life

PRECAUTIONARY STATEMENT(S)

P210	Keep away from heat/sparks/open flames/hot surfaces – No smoking
P261	Avoid breathing dust/fume/gas/vapors/spray
P273	Avoid release to the environment
P280	Wear protective gloves/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. Continue rinsing
P310	Immediately call a Poison Center or doctor/physician

POTENTIAL HEALTH HAZARDS

SKI:	Toxic if absorbed through skin. Causes skin burns.
EYES:	Causes severe eye burns.
INHALATION:	Toxic if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
INGESTION:	Not a probable route of exposure. Toxic if swallowed (e.g. unintentional hand-to-mouth transfer). Causes burns.
DELAYED EFFECTS:	None known.

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

INGREDIENT NAME	NTP STATUS	IARC STATUS	OSHA LIST	ACGIH STATUS
Cobalt Compounds	Group 2 ⁴	2B ⁵	None	A3 ⁶

⁴ Reasonably anticipated to be human carcinogens

⁵ Possibly carcinogenic to humans

⁶ Confirmed animal carcinogen with unknown relevance to humans

SECTION 3 COMPOSITION AND INFORMATION ON INGREDIENTS

<i>INGREDIENT NAME²</i>	<i>CAS NUMBER</i>	<i>WEIGHT %</i>
Water	7732-18-5	0.5 - 15
2-Aminobutane	13952-84-6	30 – 60
1-Butylamine	109-73-9	0 - 45
Co-solvent ³	Various	40 -5
Single-Wall Carbon Nanotubes	NA	<0.1
Metallic Impurities (including Silicon, Molybdenum and Cobalt, plus their Oxides or Carbides)	Various	<15ppm

This material is considered as hazardous under OSHA regulations.

² Trace impurities and additional material names not listed above may also appear in Section 15 towards the end of the SDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

³ May contain up to 40% of the following co-solvents:

Co-solvent	CAS #
Ethanol	64-17-5
2-propanol	67-63-0
1-propanol	71-23-8
2-butanol	78-92-2
1-Pentanol	71-41-0
1-Hexanol	111-27-3

SECTION 4 FIRST AID MEASURES

GENERAL:	Consult a physician. Show this safety sheet to the doctor in attendance. Move out of dangerous area.
SKIN:	In case of contact, remove contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Take victim immediately to hospital.
EYES:	Flush eyes with plenty of water for at least 15 min. Get medical attention immediately, continue to rinse while transporting to hospital.
INHALATION:	Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Consult a physician.
INGESTION:	If person is conscious, rinse mouth with water. Do not induce vomiting unless directed to do so by a physician. Consult a physician.

SECTION 5 FIRE FIGHTING MEASURES

SUITABLE EXTINGUISHING MEDIA:

Water Spray, Carbon Dioxide, Dry Chemical or Alcohol-Resistant Foam.

DECOMPOSITION PRODUCTS:

Carbon Monoxide, Carbon Dioxide, Nitrous Oxides, Water Vapor, Metal Oxides.

UNUSUAL FIRE & EXPLOSION HAZARDS:

Use water spray to cool unopened containers.

SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:

As in any fire, wear NIOSH/MSHA approved positive pressure self-contained breathing apparatus and full protective clothing, as combustion may produce hazardous fumes.

SECTION 6 ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE:

Use appropriate personal protection during clean up (Section 8). Keep unprotected personnel away.

Ensure adequate ventilation. Do not breathe product vapors, mist or gas. If product dried to a powder, avoid inhalation of the dried powder, fume and vapor as well as skin or eye contact.

Be aware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas. Remove all sources of ignition. Use spark proof tools.

For small spills soak up with absorbent material, then place in suitable container. For larger spills, contain spillage and then collect with an electrically protected vacuum cleaner (HEPA equipped vacuum) or by wet-mopping and place in suitable container.

Do not allow spilled material or wash water to enter sewers, surface water, or ground water. Refer to section 13 for disposal information.

Spills and releases may have to be reported to Federal and/or local authorities. See Section 15 regarding reporting requirements.

SECTION 7 HANDLING AND STORAGE

NORMAL HANDLING:

Always wear recommended personal protective equipment (Section 8).

Avoid splashing or misting of products. Avoid contact with eyes and skin. Do not breathe product vapor or mist.

Keep in tightly closed containers. Additional sealing may prevent accidental product release.

Use spark-proof equipment. Take measures to prevent buildup of electrostatic charge.

Use local exhaust or general room/dilution ventilation. If possible, use in a closed, well-ventilated area (e.g. fume hood). Empty containers retain residue (liquid and/or vapor) and can be dangerous. Refer to section 13 for disposal information.

STORAGE RECOMMENDATIONS: Store product in closed containers, in a cool, dry and well ventilated place, designated as "Flammables area", away from any possible source of ignition. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

SECTION 8 EXPOSURE CONTROLS AND PERSONAL PROTECTION⁵

ENGINEERING CONTROLS:

General room ventilation is adequate for storage and ordinary handling. Use local exhaust at points of use to maintain exposure below the PEL/TLV exposure limits. Ensure facilities are equipped with safety showers and eyewash stations, in close proximity to the work area.

Safety Data Sheet – V2V Aqueous Ink Single-wall Carbon Nanotube Ink

EXPOSURE GUIDELINES

INGREDIENT NAME	ACGIH TLV ⁷	OSHA PEL ⁸	OTHER LIMIT
N-Butylamine	TWA=5ppm (15mg/m ³) (Skin)	TWA=5ppm (15mg/m ³) (skin)	TWA ⁹ =5ppm (15mg/m ³) (skin)
2-Butylamine	NA	NA	None
Ethanol	TWA=1000ppm	TWA=1000ppm (1900mg/m ³)	MAK ¹⁰ =2ppm (6.1 mg/m ³)
Propanol	TWA=100ppm	TWA=200ppm, STEL ¹¹ =250ppm	NA
2-Propanol	TWA=200ppm, STEL=400ppm	TWA=400ppm, STEL=500ppm	TWA ⁸ =400ppm, STEL ⁸ =500ppm
2-Butanol	TWA=100ppm	TWA=150ppm (450mg/m ³)	TWA ⁸ =100ppm, STEL ⁸ =150ppm
1-Pentanol	NA	NA	TWA=100ppm ¹²
1-Hexanol	NA	NA	NA
Single-Wall Carbon Nanotubes	Not Available	TWA ¹³ =5 mg/m ³	TWA ^{8,12} =7µg/m ³ (respirable)
Insoluble Molybdenum Compounds, as Mo	TWA = 10 mg/m ³ (inhalable) TWA = 3 mg/m ³ (respirable)	TWA = 10 mg/m ³ (total dust)	None
Cobalt Compounds, as Co	TWA = 0.02 mg/m ³	TWA = 0.05 mg/m ³	5 µg/L urine ¹⁴ , 1 µg/L blood

⁷ Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are 8-hour TWA concentrations unless otherwise noted

⁸ PEL values represent limits established by the 1989 Air Contaminants Rule (29 CFR 1910.1000, Subpart Z, Table Z-1-A) which was subsequently revoked on June 30, 1993. Several states continue to enforce Table Z-1-A limits
OSHA Permissible Exposure Limits (PELs) are 8-hour TWA (time-weighted average) concentrations unless otherwise noted.

⁹ NIOSH REL

¹⁰ International chemical safety cards, at <http://www.cdc.gov/niosh/ipcsneng/neng0401.html>

¹¹ STEL=Short term exposure value

¹² USA. Workplace environmental exposure levels (WEEL)

¹³ NIOSH Docket Number 161-A, "Occupational Exposure to Carbon Nanotubes and Nanofibers", November 2010

¹⁴ Biological Exposure Index (ACGIH)

PERSONAL PROTECTIVE EQUIPMENT



HAND PROTECTION:

Handle with gloves that are comprised of material that successfully passes ASTM F-739 (continuous liquid contact method). Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product.

Gloves must be changed before they show degradation and before the designated breakthrough time for the carrier liquid (as determined by the ASTM F-739 testing or by the manufacturer).

SKIN AND BODY PROTECTION:

Complete suit impervious to the product, flame retardant and antistatic should be worn to prevent skin exposure.

EYE PROTECTION:

Wear chemical goggles that conform to ANSI Z87.1 under normal conditions. Wear a full-face shield if there is a potential for contact with splashed material. If the respirator is the sole means of protection, use a full-face supplied air respirator.

RESPIRATORY PROTECTION:

If there is potential for inhalation of vapors wear a full-face NIOSH approved respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls.

If the respirator is the sole means of protection, use a full face supplied air respirator.

The respirator must be selected based on contamination levels and use conditions found in the workplace. Use conditions must not exceed the working limits of the respirator.

The respirator must be used in accordance with the OSHA respiratory protection standard (29 CFR 1910.134).

HYGIENE MEASURES:

Keep away from foodstuffs, beverages and feed. Remove all soiled and contaminated material immediately. Wash hands before breaks and at the end of work.

ADDITIONAL RECOMMENDATIONS:

Detailed information on handling carbon nanotubes may be found at the ASTM Standard E2535-07 "Std guide for Handling Unbound Engineered Nano-Scaled Particles in Occupational Settings" www.astm.org

OTHER EXPOSURE LIMITS FOR POTENTIAL DECOMPOSITION PRODUCTS: None.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Black liquid
PHYSICAL STATE:	Viscous liquid
ODOR:	Amine smell
SPECIFIC GRAVITY (water = 1.0):	~0.95
SOLUBILITY IN WATER (weight %):	Miscible
pH:	Not determined
BOILING POINT:	70-160°C
% VOLATILES:	≥98%
FLASH POINT:¹⁵	Not determined

¹⁵ Flash point method and additional flammability data are found in Section 5

SECTION 10 STABILITY AND REACTIVITY

THERMAL DECOMPOSITION/CONDITIONS TO AVOID

Normally stable. Decomposition will not occur if used and stored according to specifications. Avoid heat, flames and sparks.

INCOMPATIBILITIES/MATERIALS TO AVOID:

Strong oxidizing agents, and depending on the co-solvent, strong acids, alkali metals, halides, aldehydes, peroxides, acid anhydrides, halogens, aluminum, ammonia.

HAZARDOUS DECOMPOSITION PRODUCTS:

Thermal decomposition products may include carbon monoxide, carbon dioxide, nitrogen oxides and oxides of metallic impurities (including molybdenum and cobalt).

HAZARDOUS REACTIONS:

Vapors may form explosive mixture with air.

SECTION 11 TOXICOLOGICAL INFORMATION

IMMEDIATE (ACUTE) EFFECTS:

LD50 Oral - rat – 215 mg/Kg

LC50 Inhalation – mouse – 2h – 1600mg/m³ LD50 Dermal – rabbit – 1001 mg/Kg

SIGNS & SYMPTOMS OF EXPOSURE:

One or more of this product's ingredients are extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes and skin. May cause cough, shortness of breath, headache and nausea. To the best of our knowledge, product's physical and toxicological properties have not been thoroughly investigated.

According to the co-solvent in use may cause central nervous system depression, narcosis, damage to the heart, nausea, dizziness, headache, dermatitis.

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:

Carbon Nanotubes¹⁶ – No data available

CARCINOGENICITY:

No component of this product present at levels greater or equal to 0.1% is identified as probable, possible or confirmed carcinogen by IARC, ACGIH, NTP and OSHA.

OTHER DATA:

See section 3 and RTECS: EO2975000, EO3325000 and according to the co-solvent in use, KQ6300000, UH2250000, NT8050000, EO1750000, SB9800000

¹⁶ Toxicological information on carbon nanotubes may be found at the website of International Council on Nanotechnology at <http://cohesion.rice.edu/centersandinst/icon/>.

SECTION 12 ENVIRONMENTAL INFORMATION¹⁷

TOXICITY: Toxic to fish LC50 – Leuciscus idus (golden orfe) – 47.4 mg/L – 96h

OTHER ADVERSE EFFECTS: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life

¹⁷ Additional information on ecological harms due to the presence of carbon nanotubes may be found at the website of International Council on Nanotechnology at <http://cohesion.rice.edu/centersandinst/icon/>.

SECTION 13 DISPOSAL CONSIDERATIONS

RCRA

Not classified as RCRA hazardous waste

OTHER DISPOSAL CONSIDERATIONS:

Except for small R&D samples (TSCA §5(h)(3), 40CFR 720.3 and 40CFR720.36), disposal of this product is not allowed by federal, state and local government regulations. The suspension must be destroyed in hazardous waste incinerator with an afterburner and scrubber and special care should be taken not to be released in the water.

CONTAMINATED PACKAGING:

Dispose of as unused material.

NOTE: The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

SECTION 14 TRANSPORTATION INFORMATION

US DOT HAZARD CLASS: UN-Number: 2924 Class:3 (8) Packaging group: 2
Proper shipping name: **Flammable liquid, corrosive, n.o.s.**

US DOT HAZARD CLASS: UN-Number: 2924 Class:3 (8) Packaging group: 2

For additional information on shipping regulations affecting this material, contact the information number found on Section 1.

SECTION 15 REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS:

This product contains a substance that is manufactured according to the terms of TSCA consent order, for PMN P10-0005 and should not be used for commercial purposes or in formulations used for commercial purposes, unless the recipient agrees in writing to comply with the requirements of the above consent order. As an exemption, the product can be further distributed only after it has been reacted, incorporated into an article or otherwise rendered into a physical form or state.

Containing a TSCA-exempt R&D substance, this product must be used by or directly under the supervision of technically qualified individual(s) as defined by TSCA, solely for R&D purposes.

For additional information on TSCA status, contact the information number found on Section 1.

OTHER TSCA ISSUES: None

DSL STATUS

This product contains the following components that are not on the Canadian DSL nor NDSL lists

INGREDIENT NAME	CAS-NO.
Carbon Nanotubes	NA

SARA TITLE III/CERCLA

SECTION 302 COMPONENTS: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302

SECTION 311/312 HAZARD CLASS: Fire Hazard, Immediate (Acute) Health Hazard, Chronic Health Hazard (SDS)

SECTION 313 COMPONENTS: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, section 313.

CALIFORNIA PROP.65 COMPONENTS

This product does not contain any chemicals known to State of California to cause cancer, birth or any other reproductive effects.

STATE RIGHT-TO-KNOW

INGREDIENT NAME	CAS-NO.	STATE
Carbon Nanotubes	NA	
N-Butylamine	109-73-9	Massachusetts, Pennsylvania, New Jersey
2-Butylamine	13952-84-6	Massachusetts, Pennsylvania, New Jersey
Ethanol	64-17-5	Massachusetts, Pennsylvania, New Jersey
1-Propanol	71-23-8	Massachusetts, Pennsylvania, New Jersey
2-Propanol	67-63-0	Massachusetts, Pennsylvania, New Jersey
2-Butanol	78-92-2	Massachusetts, Pennsylvania, New Jersey
1-Pentanol	71-41-0	Massachusetts, Pennsylvania, New Jersey
1-Hexanol	111-27-3	Pennsylvania, New Jersey

ADDITIONAL REGULATORY INFORMATION

WHMIS CLASSIFICATION (CANADA): Not determined.

FOREIGN INVENTORY STATUS:

Single-Wall Carbon Nanotubes being one of product's components are listed on the following inventories

Australian (AICS)	Canadian (DSL)
Chinese (IECSC)	European (EINECS)
Japanese (ENCS)	Korean (KECI)

SECTION 16 OTHER INFORMATION

CURRENT ISSUE DATE: November 30, 2016

PREVIOUS ISSUE DATE February 3, 2016
September 9, 2012

CHANGES TO SDS FROM PREVIOUS ISSUE DATE ARE DUE TO THE FOLLOWING:

November 30, 2016: updated logo and renamed document
February 3, 2016: Updated logo and manufacturer information

OTHER INFORMATION: None.

DISCLAIMER:

THE INFORMATION HEREIN IS PROVIDED IN GOOD FAITH, AND IS BELIEVED TO BE ACCURATE. NO WARRANTY, EXPRESSED OR IMPLIED, IS MADE REGARDING THE ACCURACY OR COMPLETENESS OF THIS INFORMATION. FURTHERMORE, CHASM ADVANCED MATERIALS MAKES NO REPRESENTATION OR WARRANTY THAT THE SAMPLE IS FIT FOR ANY PARTICULAR PURPOSE AND CHASM ADVANCED MATERIALS EXPRESSLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY. THIS DOCUMENT IS INTENDED ONLY AS A PRECAUTIONARY GUIDE FOR THE APPROPRIATE HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, WHO MUST EXERCISE INDEPENDENT JUDGMENT IN DETERMINING HANDLING OF THIS PRODUCT AND THE APPROPRIATENESS OF THIS PRODUCT FOR ANY PURPOSE. CHASM ADVANCED MATERIALS SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES OR FOR DAMAGE TO PERSONS OR PROPERTY RESULTING FROM ITS USE. NOTHING HEREIN SHALL BE CONSTRUED AS A RECOMMENDATION FOR USE IN VIOLATION OF ANY PATENT.

CAUTION! POTENTIAL HAZARDS OF THIS EXPERIMENTAL PRODUCT ARE UNKNOWN.

MANUFACTURED UNDER U.S. PATENT NOS. #6,333,016, #6,413,487, #6,955,800 AS WELL AS OTHER PENDING PATENT APPLICATIONS IN THE U.S. AND AROUND THE WORLD.