

SAFETY DATA SHEET

Product: Single-Wall Carbon nanotube in aqueous solution

(1) PRODUCT AND COMPANY IDENTIFICATION

Identification of the substance or preparation

TRADE/MATERIAL NAME: Carbon nanotube, single-walled
CHEMICAL NAME: Carbon nanotube
SYNONYMS: CNT (carbon nanotube), SWNT (single-walled-nanotube), SWCNT (single-walled-carbon-nanotube)

This SDS is valid for the following SWCNT Grades:

IsoNanotubes-S, IsoNanotubes-M, SuperPureTubes, PureTubes,
SuperPurified PlasmaTubes.

Use of the substance/Preparation: For laboratory research purposes.

Supplier: Raymor Nanotech, division of Raymor Industries Inc.
3765 La Vérendrye
Boisbriand, Quebec, J7H 1R8
CANADA
Phone No.: +1 450.434.1004

Emergency Telephone: US: CHEMTREC 1-800-424-9300 or 1-703-527-3887
Canada: CANUTEC 1-613-996-6666 (24 hour transportation emergency)

(2) HAZARDS IDENTIFICATION (EC)

GHS Classification

Eye irritation (Category 2A)
Specific target organ toxicity - single exposure (Category 3)
Suspected of causing cancer (Category 3, voluntary classification due to nickel content)
May cause an allergenic skin reaction (Category 3, voluntary classification due to nickel content)

GHS Label elements, including precautionary statements



WHMIS Classification

D2B Toxic Material Causing Other Toxic Effects Moderate respiratory irritant

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Moderate eye irritant

Hazard statement(s)

H319 Causes serious eye irritation.
H335 May cause respiratory irritation.

Precautionary statement(s)

P261 Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

HMIS Classification

Health hazard: 2

Flammability: 0

Physical hazards: 0

Potential Health Effects

Limited evidence of carcinogenic effect (voluntary classification due to nickel content)

May cause sensitization due to skin contact (voluntary classification due to nickel content)

Inhalation: May be harmful if inhaled. Causes respiratory tract irritation.

Skin: May be harmful if absorbed through skin. Causes skin irritation.

Eyes: Causes eye irritation.

Ingestion: May be harmful if swallowed.

Hazard codes: Xi

Risk Statements: R36/37/38/40/43

(3) COMPOSITION/INFORMATION ON INGREDIENTS

<u>INGREDIENT NAME</u>	<u>CAS NUMBER</u>	<u>WEIGHT PERCENT</u>	<u>EC NUMBER</u>	<u>EC CLASSIFICATION</u>
<u>Water</u>	7732-18-5	> 99%	231-791-2	-
<u>Synthetic graphite (carbon nanotube)</u>	7782-42-5	< 1 %	231-955-3	Xi R36/37/38
<u>Surfactant</u>	361-09-1 151-21-3	< 1 %	206-643-5 205-788-1	-
<u>Mixture of Nickel and</u>	7440-02-0		231-111-4	T F R11 R40 R43 R48/23 R52/53
<u>Iron and</u>	7439-89-6	< 1 %	231-096-4	F R11 Xn R42/43, R53
<u>Cobalt</u>	7440-48-4		231-158-0	T F R11 R40 R43 R48/23 R52/53

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(4) FIRST AID MEASURES

<u>Eye contact:</u>	Immediately flush eyes gently and thoroughly, including under the eyelids, with clean running water for 20 minutes. Remove contact lenses if present after the first 5 minutes and continue flushing for several more minutes.
<u>Skin contact:</u>	Wash thoroughly with soap and water. If irritation develops and persists, seek medical attention.
<u>Inhalation:</u>	Remove victim to fresh air. Restore and/or support breathing as needed. Seek medical attention.
<u>Ingestion:</u>	Rinse mouth. Call poison control centre or local physician. Do NOT induce vomiting.

(5) FIRE-FIGHTING MEASURES

<u>Suitable extinguishing media:</u>	Water fog, carbon dioxide, dry chemical, foam.
<u>Decomposition products:</u>	Carbon monoxide, carbon dioxide and metal oxide
<u>Special protective equipment for fire-fighters:</u>	Wear NIOSH-approved self-contained breathing apparatus (SCBA) if the fire is large.

(6) ACCIDENTAL RELEASE MEASURES

<u>Personal precautions:</u>	Wear protective equipment. Keep unprotected persons away. Ensure adequate ventilation. Keep away from ignition sources. Prevent the formation of dust-air mixture.
<u>Environmental precautions:</u>	Keep spilt material away from drains and runoff, ground-water and soil.
<u>Methods for clean-up:</u>	Contain and collect liquid with an inert absorbent and place in a container for disposal. Clean spill area thoroughly with soap and water. Report spills to authorities as required.

(7) HANDLING AND STORAGE

<u>Handling:</u>	Minimize breathing of vapours and avoid prolonged or repeated contact with skin. Wear proper protective equipment. If ventilation is not efficient, wear proper respiratory equipment. Detailed information on handling carbon nanotubes may be found at the ASTM Standard E 2535-07, "Standard Guide for Handling Unbound Engineered Nanoscale Particles in Occupational Settings," ASTM International, Ensure good ventilation of the workplace. Avoid dust formation. Keep work areas clean and free of waste. Avoid contact with skin and eyes.
<u>Storage:</u>	Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Store away from strong oxidizing and reducing agents. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition; they may explode and

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cause injury or death.

(8) EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure limit values
for carbon nanotubes:

NIOSH Exposure Limit Value : 0.01 mg/m³ (ACGIH)
German Maximale Arbeitsplatzkonzentration (MAK) : 6 mg/m³
British Occupational Exposure Limit (OEL) : 3.5 mg/m³
Italian Exposure Limit: 3.5 mg/m³ TWA; * 7 mg/m³ STEL **
NEDO Projet "Research and Development of Nanoparticle Characterization Methods" :
0.03 mg/m³ (based on a 4 week test with full-body inhalation by Nakanishi et al.,
2011).

* Time-weighted average ** Short-term exposure limit

Occupational exposure
controls:

Install and operate general and/or local exhaust ventilation systems of sufficient power to maintain airborne concentration below the defined or recommended limit (such as NIOSH exposure limit value). If possible, manipulate under fume hood to avoid exposure.

Respiratory protection:

Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard, such as OSHA 1910.134, ANSI Z88.2. Respirator selection must be based on known or anticipated exposure levels, the hazards of the material, and the safe working limits of the selected respirator. Follow OSHA respirator regulation (29 CFR 1910.134) and, if necessary, wear an MSHA/NIOSH-approved respirator. For little exposure, use type P95 (NIOSH) or type P1 (EN 143) respirators. For high exposure, use type P99 (NIOSH) or type P2 (EN 143) respirators. For further details, please consult the following ISO documents ISO/TS 12901-1:2012: Occupational risk management applied to engineered nanomaterials -- Part 1: Principles and approaches, as well as ISO/TS 12901-2:2014 : Occupational risk management applied to engineered nanomaterials -- Part 2: Use of the control banding approach.

Hand protection:

Handle with chemical resistant gloves. Wash with soap and dry hands after manipulation.

Eye protection:

Wear safety glasses conforming to an approved standard, such as NIOSH (US) or EN 166 (EU).

Skin protection:

Wear protective clothing to prevent contact with skin. The type of clothing must depend on the level of exposure to the product.

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(9) PHYSICAL AND CHEMICAL PROPERTIES

General Information: Appearance – Solution: IsoNanotubes-M (Green), IsoNanotubes-S (Pink), Plasma/
PureTubes (Dark Brown)
Odour – Mild soap scent

Important health, safety and environmental information:

pH: Not applicable.
Boiling point: ~ 100 °C
Flash point: ~ 120 °C at 1.1 atmospheres
Explosive properties: Not available
Oxidising properties: Not expected.
Vapour pressure: ~18.7 mm Hg at 21 °C
Solubility in water: Complete
Partition coefficient: Not applicable.
Evaporation rate: ~1.958x10⁻⁴ at 21°C
Specific gravity: ~1.0 at 21°C

Other Information:

Melting point: ~ 0.0 °C

(10) STABILITY AND REACTIVITY

This product is stable under normal storage conditions.

Conditions to avoid: Ignition source.

Materials to avoid: Oxidising and reducing agents.

Hazardous decomposition products: Under fire conditions: carbon monoxide and carbon dioxide.

(11) TOXICOLOGICAL INFORMATION

Acute toxicity:

Irritant effect on skin: Skin contact with carbon nanotubes may cause irritation.
Irritant effect on the eye: Eye contact has shown irritation.
Respiratory or skin sensitization: Due to the nickel content, carbon nanotubes may cause skin sensitization.
Inhalation: Inhalation can cause irritation.
Ingestion: May be harmful if swallowed.

Delayed (chronic and subchronic) toxicity:

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Chronic effects on humans:	Pure SDS powder has the following known Mutagenic Effects: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: skin.
Genotoxicity:	<i>In vitro</i> : Carbon nanotubes have the following known Mutagenic Effects: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: skin. <i>In vivo</i> : No formation of micronucleus (NEDO project, Nakanishi <i>et al</i> , 2011).
Carcinogenicity and Teratogenicity	To our knowledge, this product is not considered teratogenic. Possible carcinogenic effect due to the nickel content.

(12) ECOLOGICAL INFORMATION

No known significant effects or critical hazards.

(13) DISPOSAL CONSIDERATIONS

The generation of waste should be avoided or minimised whenever possible. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Disposal of this product, and any by-product should at all times comply with the requirements of environmental protection and waste disposal legislation and any national, regional and local authority requirements.

(14) TRANSPORT INFORMATION

<u>Hazard Classes:</u>	This material is not defined under US DOT regulations as a hazardous substance.
<u>UN Number:</u>	Not applicable
<u>Shipping Name:</u>	Not applicable
<u>Class:</u>	Not applicable
<u>Packing Group:</u>	Not applicable
<u>Label:</u>	Not applicable
ICAO/IATA Classification:	This material is not defined under the US DOT regulations, "Dangerous Chemicals Management Ordinance," or Dangerous Goods Regulations (DGR), and is suitable for all normal transport by air, ground, rail, or water ways.
RID/ADR Classification:	This material is not classified as Dangerous Goods in the hazard communication tool (GHS) or transport conditions (TDG) by the United Nations Economic Commission for Europe (UNECE) and is suitable for all modes of transport.

(15) REGULATORY INFORMATION

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EU REGULATIONS

Hazard Symbol:



Xi

Irritant

Risk phrases:

R36/37/38 Irritating to eyes, respiratory system and skin.
R40/43 Carcinogenic effect, sensitization by skin contact

Safety phrases:

S7 Keep container tightly closed.
S22 Do not breathe dust.
S29 Do not empty into drains.
S36/37/39 Wear suitable protective clothing such as a Tyvek suit with a hood, nitrile gloves and eye/face protection such as goggles. Wearing a positive atmosphere personal respirator (PAPR) equipped with P100 air filters is recommended.

CANADIAN REGULATIONS

WHMIS Classification:

Class D2B Toxic material
Moderate eye irritant causing other toxic effects
Moderate respiratory irritant

WHMIS Symbol:



U.S. FEDERAL REGULATIONS

CERCLA 103 Reportable
Quantity:

This product is not subject to CERCLA reporting requirements.
Report large volume spills as required under federal, state, and local regulations.

SARA TITLE III:

Not available.

EPA Toxic Substances
Control Act (TSCA) Status:

Not applicable.

California Safe Drinking
Water and Toxic
Enforcement Act (Proposition
65):

This product does not contain chemicals regulated under
California Proposition 65.

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VOC Regulations: This product complies with the consumer product VOC limits of CARB, the US EPA, and states adopting the OTC VOC rules.

(16) OTHER INFORMATION

NFPA Classification:

Not classified

Full Text of R-phrases in Section 2 & 3:

R36/37/38 Irritating to eyes, respiratory system and skin.
R40/43 Carcinogenic effect, sensitization by skin contact,

Full Text of classification in Section 2 & 3:

Xi Irritant

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August, 2015

Notice:

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist. The information contained herein was not obtained from toxicology assays using our single-wall carbon nanotubes but gathered from literature.