

SAFETY DATA SHEET**Product: Carbon nanotube, single-walled****(1) PRODUCT AND COMPANY IDENTIFICATION**Identification of the substance or preparation

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

This SDS is valid for the following

SWCNT Grades: IsoNanotubes-M, IsoNanotubes-S, PureTubes, HiPco.
Single-walled carbon nanotubes in aqueous surfactant solution or thick film powder.

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

Distributor: NanoIntegris Technologies, Inc.,
c/o Raymor Industries Inc.
3765 La Vérendrye
Boisbriand, Quebec, J7H 1R8
CANADA
Phone No.: +1 450.434.6266

Emergency Telephone: 1-888-CANUTEC (226-8832) (North American use) and/or
1-613-996-6666 (International use)

(2) HAZARDS IDENTIFICATIONGHS 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 statementsWHMIS Classification

D2B Toxic Material Causing Other Toxic Effects Moderate respiratory irritant

Moderate eye irritant

SAFETY DATA SHEET**Product: Carbon nanotube, single-walled**Hazard statement(s)

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

Precautionary statement(s)

P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ 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: XiRisk Statements: R36/37/38/40/43**(3) COMPOSITION / INFORMATION ON INGREDIENTS**

<u>INGREDIENT NAME</u>	<u>CAS NUMBER</u>	<u>PERCENT</u>	<u>EC NUMBER</u>	<u>EC CLASSIFICATION</u>
<u>Synthetic graphite (carbon nanotube)</u>	7782-42-5	> 95 % wt. for IsoNanotubes-S, IsoNanotubes-M, PureTubes, > 85% for HiPco	231-955-3	Xi R36/37/38
<u>Mixture of Nickel and</u>	7440-02-0	< 5 % wt. for IsoNanotubes-S, IsoNanotubes-M, PureTubes, <15% for HiPco	231-111-4	T F R11 R40 R43 R48/23 R52/53
<u>Iron and</u>	7439-89-6		231-096-4	F, R11, Xn R42/43, R53
<u>Cobalt and</u>	7440-48-4		231-158-0	T, F, R11, R40, R43, R48/23, R52/53
<u>Yttrium</u>	7440-65-5		231-174-8	F, R11

SAFETY DATA SHEET**Product: Carbon nanotube, single-walled****(4) FIRST AID MEASURES**

- Eye contact: Immediately flush eyes gently and thoroughly, including under the eyelids, with clean running water for 20 minutes.
- Skin contact: Wash thoroughly with soap and water. Seek medical attention.
- Inhalation: Remove victim to fresh air. Restore and/or support breathing as needed. Seek medical attention.
- Ingestion: Call poison control centre. Never give anything by mouth to someone is unconscious or convulsing. Seek medical attention.

(5) FIRE-FIGHTING MEASURES

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

(6) ACCIDENTAL RELEASE MEASURES

- Personal precautions: Wear protective equipment. Keep unprotected persons away. Ensure adequate ventilation. Keep away from ignition sources. Prevent the formation of dust-air mixture.
- Environmental precautions: Keep spilt material away from drains and runoff, ground-water and soil.
- Methods for clean-up: Collect spilled material using a vacuum with HEPA filter. Avoid formation of dust.

(7) HANDLING AND STORAGE

- Handling: Ensure good ventilation of the workplace. Avoid dust formation. Keep powder away from open flames and other sources of ignition. Keep work areas clean and free of waste. Avoid contact with skin and eyes.
- Storage: Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Store away from strong oxidizing and reducing agents.

SAFETY DATA SHEET**Product: Carbon nanotube, single-walled****(8) EXPOSURE CONTROLS/PERSONAL PROTECTION**

<u>Exposure limit values:</u>	<p>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).</p> <p>* Time-weighted average ** Short-term exposure limit</p>
<u>Occupational exposure controls:</u>	<p>Install and operate general and/or local exhaust ventilation systems of sufficient power to maintain airborne concentration below the defined or recommended limit. If possible, manipulate under fumehood to avoid exposure.</p>
<u>Respiratory protection:</u>	<p>Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard, such as NIOSH (US) or EN 143 (EU). 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. 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, ainsi que ISO/TS 12901-2:2014 : Occupational risk management applied to engineered nanomaterials -- Part 2: Use of the control banding approach.</p>
<u>Hand protection:</u>	<p>Handle with protecting gloves. Wash and dry hands after manipulation.</p>
<u>Eye protection:</u>	<p>Wear safety glasses conforming to an approved standard, such as NIOSH (US) or EN 166 (EU).</p>
<u>Skin protection:</u>	<p>Wear protective clothing to prevent contact with skin. The type of clothing must depend on the level of exposure to the product.</p>

SAFETY DATA SHEET**Product: Carbon nanotube, single-walled****(9) PHYSICAL AND CHEMICAL PROPERTIES**

General Information: Appearance – black powder
Odour – None

Important health, safety and environmental information:

pH: Not applicable.
Boiling point: Not available
Flash point: Not available.
Explosive properties: Not available
Oxidising properties: Not expected.
Vapour pressure: Not applicable.
Relative density: 1.4 (H₂O = 1)
Solubility: Not available.
Water solubility: Insoluble.
Partition coefficient: Not applicable.
Viscosity: Not applicable.
Vapour density: Not applicable.
Evaporation rate: Not applicable.

Other Information:

Melting point: 3652 – 3697 °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.

SAFETY DATA SHEET**Product: Carbon nanotube, single-walled****(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:

Genotoxicity: *In vitro*: No increased frequency of mutation and no chromosome abnormality were observed (NEDO project, Nakanishi *et al.*, 2011).
In vivo: No formation of micronucleus (NEDO project, Nakanishi *et al.*, 2011).

Carcinogenicity and Teratogenicity: To our knowledge, this product is not considered teratogenic. Possible carcinogenic effect due to the nickel content.

In addition to the toxicological information detailed above, some of the individual ingredients composing the single-wall carbon nanotubes might have toxicological properties.

Nickel dust and fumes:

Can cause irritation of eyes, skin and respiratory tract.

Chronic overexposures: Can cause perforation of the nasal septum, inflammation of the nasal passages (sinusitis), respiratory sensitization, asthma and scarring of the lungs (pulmonary fibrosis).

Nickel alloys IARC/NTP: Reviewed but not recommended for listing by the NTP. Listed as possibly carcinogenic to humans by IARC (group 2B).

(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.

SAFETY DATA SHEET**Product: Carbon nanotube, single-walled****(14) TRANSPORT INFORMATION**

UN Number: Not applicable

Shipping Name: Not applicable

Class: Not applicable

Packing Group: Not applicable

Label: Not applicable

(15) REGULATORY INFORMATION**EU REGULATIONS**Hazard Symbol:

Xi

Irritant

Risk phrases:R36/37/38
R40/43Irritating to eyes, respiratory system and skin.
Carcinogenic effect, sensitization by skin contactSafety phrases:S7
S22
S29
S36/37/39Keep container tightly closed.
Do not breathe dust.
Do not empty into drains.

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 REGULATIONSWHMIS Classification:Class D2B Toxic material
causing other toxic effectsModerate eye irritant
Moderate respiratory irritantWHMIS Symbol:

SAFETY DATA SHEET

Product: Carbon nanotube, single-walled

(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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4

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November 2016

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.