COPPER POWDER / FLAKE

(1-10 micron nominal)

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: NDCopper Powder
NDCopper Flake

Product use: Metal powder (1 – 10 micron nominal) used for microelectronics.

MANUFACTURER:

NanoDynamics, Inc.
901 Fuhrmann Blvd.
Buffalo, New York 14203

FOR MORE INFORMATION CALL: (716)853-4900
IN CASE OF EMERGENCY CALL: **For Chemical Emergency Spill, Leak, Fire, Exposure or Accident call CHEMTREC 1-800-424-9300**

2. COMPOSITION / INFORMATION ON INGREDIENTS

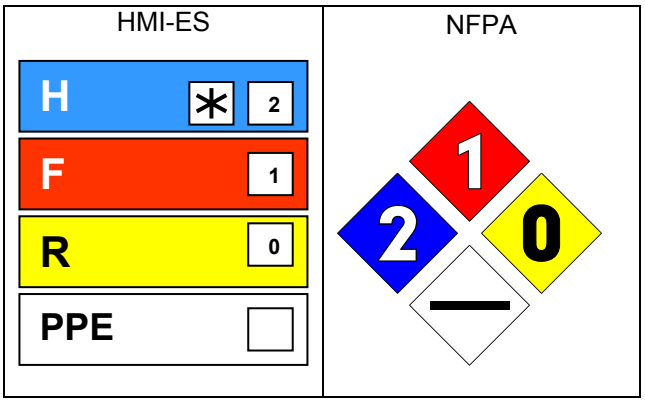
INGREDIENT NAME:	CAS NUMBER	WEIGHT %
Copper	7440-50-8	> 99.0 %

This material is classified as hazardous under OSHA regulations (29CFR 1910.1200).

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

Reddish brown solid powder, no odor.
Warning! Harmful if inhaled. Causes respiratory tract irritation. Inhalation of fumes may cause 'Metal Fume Fever', a flu-like illness. Prolonged or repeated inhalation may cause chronic respiratory disease. May cause skin and eye irritation. May be harmful if swallowed. May cause liver and kidney damage. Keep away from oxidizing agents and other incompatible material. Avoid and control operations which generate dust. Avoid exposure to air and moisture.



POTENTIAL HEALTH HAZARDS

Target organs: Skin, eyes, respiratory system, digestive system, liver, kidneys.
Routes of exposure: Skin contact, skin absorption, eye contact, inhalation, ingestion.
Signs and symptoms of short-term (acute) exposure:

SKIN: May cause irritation. Symptoms may include redness, itching and pain. Could cause greenish-black skin discoloration. This product may be absorbed.

EYES: May cause irritation, discoloration and damage.

INHALATION: Harmful if inhaled. Inhalation of dusts or fumes may cause nose, throat and respiratory tract irritation. Symptoms may include congestion of nasal mucous membranes, and ulceration and perforation of the nasal septum ("bone" that divides nose). Inhalation of fumes may cause metal fume fever, a flu-like illness with symptoms including high temperature, metallic taste in mouth, nausea, general weakness and muscle aches.

INGESTION: Harmful if swallowed. May cause nausea, vomiting, pain and a metallic taste in the mouth. Ingestion of larger doses could cause stomach ulceration, jaundice, and liver and kidney damage.

CHRONIC AFFECTS: Chronic ingestion could cause liver and kidney damage. Prolonged or repeated inhalation could cause respiratory irritation and chronic respiratory disease. Prolonged or repeated skin contact could cause discoloration of the skin and hair.

PRE-EXISTING MEDICAL CONDITONS AGGRAVATED: May aggravate pre-existing skin, respiratory, digestive, liver and kidney problems.

4. FIRST AID MEASURES

SKIN: Remove contaminated clothing and shoes. Wash skin thoroughly with soap and water. Obtain medical attention. Launder clothing before reuse.

EYES: Immediately flush eyes with running water for a minimum of 15 minutes. Obtain medical attention.

INHALATION: Immediately remove person to fresh air. If breathing is difficult, administer oxygen. If breathing has stopped, begin artificial respiration. Obtain medical attention immediately.

INGESTION: Contact a physician or Poison Control Centre immediately! Inducing vomiting should only be performed under the direct supervision of medical personnel. Never give anything by mouth to an unconscious or convulsing person.

5. FIRE FIGHTING MEASURES

Fire hazards/conditions of flammability:
Not considered flammable. This material may, however, present a low dust explosion hazard. Copper powder with particle sizes in the 50 µm size range are classified as weakly explosive by the US Bureau of Mines report RI-6516. When present as a dust cloud, the material will not readily explode and is not easily ignited by sparks.

FLAMMABLE PROPERTIES

FLASH POINT:	>1292°F / 700°C
AUTOIGNITION TEMPERATURE:	Not available.
UPPER FLAME LIMIT (volume % in air):	Not applicable
LOWER FLAME LIMIT (volume % in air):	Not applicable
OSHA FLAMMABILITY CLASS:	(OSHA 29 CFR 1910.1200): Non-flammable.

EXTINGUISHING MEDIA:
Class D fire extinguishers using Sodium chloride are preferable**. DO NOT USE WATER**.

SPECIAL FIRE FIGHTING PRECAUTIONS / INSTRUCTIONS:
Do not enter fire area without proper protection. Fire fighters should wear proper protective equipment and self-contained breathing apparatus with full face piece. Move containers from fire area if it can be done without risk. Water spray may ONLY be useful in cooling equipment exposed to heat and flame.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. All persons dealing with clean-up should wear the appropriate chemically protective equipment. Keep all other personnel upwind and away from the spill/release. Refer to Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION, for additional information on acceptable personal protective equipment.

Environmental precautions: Ensure spilled product and flush solutions do not enter drains, sewers, waterways or confined spaces.

IN CASE OF SPILL OR OTHER RELEASE: Eliminate all sources of ignition. Ventilate area of release. Stop leak if you can do so without risk. Using HEPA vacuum, wet vacuum, or other dustless methods, gather up spilled material and place in suitable container for later disposal (see Section 13). Avoid generating dust. Contaminated absorbent material may pose the same hazards as the spilled product. Notify the appropriate authorities as required.

Special spill response procedures: If a spill/release in excess of EPA reportable quantity is made into the environment, immediately notify the national response center in the United States (phone: 1-800-424-8002).
DOT/CERCLA Reportable Quantity (RQ): Copper (RQ 5000 lbs.)

7. HANDLING AND STORAGE

NORMAL HANDLING: This material is a harmful solid. Wear suitable protective equipment for dusty conditions during handling. Use only in a well-ventilated area. Avoid breathing dusts or fumes. Avoid contact with eyes, skin and clothing. Keep away from extreme heat and flame. Avoid and control operations which create dust. Keep away from oxidizing materials and other incompatibles. Avoid exposure to air and moisture. Keep container tightly closed when not in use. Assume empty containers contain residues, which are hazardous. Wash hands before eating, drinking, smoking or use of toilet facilities. Immediately remove soiled clothing and wash it thoroughly before reuse.

STORAGE RECOMMENDATIONS: Store in a cool, dry, well-ventilated area away from heat, flame and incompatible materials. Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Inspect periodically for damage or leaks. No smoking in the area.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Use adequate ventilation to maintain air contaminants below exposure limits. Local or exhaust ventilation recommended for prolonged exposures or if the TLV is not known.

PERSONAL PROTECTIVE EQUIPMENT

SKIN PROTECTION: Protective gloves impervious to the material should be worn during use. Advice should be sought from glove suppliers. Additional protective clothing, such as long sleeve shirts and/or coveralls, is recommended. An eyewash station and safety shower should be made available in the immediate working area.

EYE PROTECTION: Use chemical goggles to prevent dusts from entering the eyes. Contact lenses should not be worn.

RESPIRATORY PROTECTION: Respiratory protection is required if the airborne concentration exceeds the TLV. Use NIOSH-approved respirators suitable for dusts. Advice should be sought from respiratory protection specialists.

General hygiene considerations: Avoid inhalation of dusts or fumes. Avoid contact with eyes, skin and clothing. Do not eat, drink or smoke when working. Upon completion of work, wash hands before eating, drinking, smoking or use of toilet facilities. Immediately remove soiled clothing and wash it thoroughly before reuse.

EXPOSURE GUIDLINES

INGREDIENT NAME	ACGIH TLV	OSHA PEL
Copper	1 mg/m^3 (Dusts and mists, as Cu) 0.2 mg/m^3 (Fume)	1 mg/m^3 (Dusts and mists - as Cu) 0.1 mg/m^3 (Fume – as Cu)

[1] = Limit established by General Chemical Corporation
[2] = Workplace Environmental Exposure Level (AIHA)
[3] = Biological Exposure Index (ACGIH)

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Reddish brown
PHYSICAL STATE: Solid powder
MOLECULAR WEIGHT: 63.54
CHEMICAL FORMULA: Cu
ODOR: No odor
SPECIFIC GRAVITY (water = 1.0): 8.9
SOLUBILITIY IN WATER (weight %): Insoluble
pH: N/Ap
BOILING POINT: 4703°F (2595°C)
MELTING POINT: 1981°F (1083°C)
VAPOR PRESSURE: 1 @ 2962°F / 1628°C
VAPOR DENSITY (air = 1.0): N/Ap
EVAPORATION RATE: N/Ap **COMPARED TO:** N/Ap
% VOLATILES: 0
FLASH POINT: >1292°F / 700°C
(Flash point method and additional flammability data are found in Section 5.)

10. STABILITY AND REACTIVITY

NORMALLY STABLE? (CONDITIONS TO AVOID):
Stable under the recommended storage and handling conditions prescribed. May turn green on prolonged contact with moist air, due to the formation of cupric carbonate.

INCOMPATIBILITIES:
Acetylene, strong oxidizing material (e.g. chlorates, bromates, iodates, ammonium nitrate, hydrogen peroxide, sodium azide), chlorine, fluorine, 1-bromo-2-propyne, potassium dioxide

HAZARDOUS DECOMPOSITION PRODUCTS:
None known. Refer to Section 5 for 'Hazardous combustion products'

HAZARDOUS POLYMERIZATION:
Will not occur.

CONDITIONS TO AVOID:
Avoid sources of heat and flame. Moist air. Avoid contact with incompatibles.

11. TOXICOLOGICAL INFORMATION

IMMEDIATE (ACUTE) EFFECTS:
There is no available data for the product itself, only for the ingredients. See below for individual ingredient acute toxicity data

	LC_{50}(4hr)	LD_{50} (mg/kg)	
Ingredients	**inh, rat**	**oral, rat**	**dermal, rabbit**
Copper	N/Av	N/Av	N/Av

OTHER DATA:

Carcinogenicity: None of the ingredients listed are classified by IARC, ACGIH, NTP or OSHA as carcinogenic.

Reproductive effects, Teratogenicity, Mutagenicity: None known.

Sensitization to material: May cause allergic contact dermatitis in hypersensitive individuals. Symptoms may include itching, redness, swelling and pustulation.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The ecological characteristics of this product have not been fully investigated. The product should not be allowed to enter drains or water courses or be deposited where it can affect ground or surface waters. Do not discharge product unmonitored into the environment.

13. DISPOSAL CONSIDERATIONS

RCRA

If this product, as supplied, becomes a waste, it may meet the criteria of a hazardous waste as defined under RCRA, Title 40 CFR 261. It is the responsibility of the waste generator to determine the proper waste identification and disposal method. For disposal of unused or waste material, check with local, state and federal environmental agencies.

Is the unused product a RCRA hazardous waste if discarded? ☐ **Yes** ☒ **No**

If yes, the RCRA ID number is:

OTHER DISPOSAL CONSIDERATIONS:

Handling for disposal: Handle according to recommendations listed in Section 7.

Methods of disposal: Dispose in accordance with all applicable federal, state and local regulations. Contact your local, state or federal environmental agency for specific rules.

The information offered in section13 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.

14. TRANSPORT INFORMATION

US DOT HAZARD CLASS: Not regulated
US DOT ID NUMBER: N/Ap
PROPER SHIPPING NAME: N/Ap

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

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS: All ingredients are listed on the TSCA inventory.

OTHER TSCA ISSUES:

SARA TITLE III / CERCLA

Sec. 313, Toxic Chemicals Notification, 40 CFR 372: This product may be subject to the TSCA notification requirements, since it contains Copper, a Toxic Chemical constituent. This product also contains the following Toxic Chemical constituents at trace levels (below de minimus concentrations): Silver (CAS # 7440-22-4), Nickel (CAS # 7440-02-0), Aluminum (CAS # 7429-90-5), Cobalt (CAS # 7440-48-4), Chromium (CAS # 7440-47-3), Manganese (CAS # 7439-96-5).

EPA / CERCLA (40 CFR 302.4) information: This product contains the following chemicals with established reportable quantities and which are designated as hazardous under CERCLA (40 CFR 302.4):

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Chemical	CAS #	% (weight)	CERCLA Reportable Quantities (RQ's)
Copper	7440-50-8	90 - 100	5000 lbs.
Sodium	7440-23-5	<0.1	10 lbs.
Silver	7440-22-4	<0.1	1000 lbs.
Nickel	7440-02-0	<0.1	100 lbs.
Chromium	7440-47-3	<0.1	5000 lbs.

STATE RIGHT-TO-KNOW

California Proposition 65: This product contains trace levels of Nickel (CAS # 7440-02-0) and Cobalt (CAS # 7440-48-4). These chemicals are known to the State of California to cause cancer.
New Jersey Labeling Requirements: This product contains the following substances required to be disclosed on product labeling:

Chemical Name	CAS #	% (weight)	New Jersey Hazardous Substance
Copper	7440-50-8	90 - 100	Yes

WHMIS CALSSIFICATION (CANADA):

Class D2B (Materials Causing Other Toxic Effects, Toxic Material)

FOREIGN CHEMICAL CONTROL INVENTORY STATUS:

Canadian CEPA information: All ingredients listed are present on the DSL.

16. OTHER INFORMATION

HMI-ES Rating:

0 - Insignificant 1 - Slight 2 - Moderate 3 - High 4 – Extreme

* - Chronic Hazard

Health: *2 Flammability: 1 Reactivity: 0

CURRENT ISSUE DATE: 5/20/05

PREVIOUS ISSUE DATE: 3/23/04

CHANGES TO MSDS FROM PREVIOUS ISSUE DATE ARE DUE TO THE FOLLOWING:
Entire Document has been revised due to the Professional Recommendations of a Regulatory Specialist at (ICC) The Compliance Center.

OTHER INFORMATION:

Legend: ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstract Services
CEPA: Canadian Environmental Protection Act
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR: Code of Federal Regulations
DOT: Department of Transportation
DSL: Domestic Substances List
EPA: Environmental Protection Agency
EST: Eastern Standard Time
HSDB: Hazardous Substances Data Bank
IARC: International Agency for Research on Cancer
IATA: International Air Transport Association
ICAO: International Civil Aviation Organization
N/Ap: not applicable
N/Av: not available
NIOSH: National Institute of Occupational Safety and Health
NTP: National Toxicology Program
OSHA: Occupational Safety and Health Administration
PEL: Permissible Exposure Limit
RCRA: Resource Conservation and Recovery Act
SARA: Superfund Amendments & Reauthorization Act
TLV: Threshold Limit Values
TSCA: Toxic Substance Control Act
WHMIS: Workplace Hazardous Materials Information System

References:
1. ACGIH, Threshold Limit Values and Biological Exposure Indices for 2004.
2. International Agency for Research on Cancer Monographs, searched 2005.
3. Canadian Centre for Occupational Health and Safety, CCInfoWeb databases, searched 2005 (Chempendium, HSDB and RTECs).
4. US EPA Title III List of Lists – January 27, 2005 version.
5. California Proposition 65 List – March 4, 2005 version.