SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

1.1 PRODUCT IDENTIFIERS

PRODUCT NAME: Copper Ink
PRODUCT CODE: **DTI Cu Ink**
REACH: No record available for the mixture as the substance or its use are exempted from registration according to Article 2 of the REACH regulation (EC) No 1907/2006, the annual tonnage does not require a registration or the registration is planned for later.

CHEMICAL NAME: Cu particles
CHEMICAL FORMULA: Cu, Propylenglycol, Polyvinylpyrrolidon, additive (<

1.2 PRODUCT USES

IDENTIFIED USES: Conductive inks, printed electronics, consumer electronics and sensors.

1.3 SUPPLIER

MANUFACTURER: Danish Technological Institute
DIVISION: Material Division
ADDRESS: Gregersensvej 1, DK 2630 Taastrup

Phone: +45 72 20 20 00
Web: www.dti.dk
Centre Phone: +45 72 20 25 70
Contact persons: **Zahary J. Davis, Team Manager, Ph.D. /Christian Kallesøe, Director, Ph.D.**
Emails: zjd@dti.dk / chkl@dti.dk

PREPARED BY: Danish Technological Institute

1.4 EMERGENCY CONTACT

EMERGENCY CALL NUMBER (EUROPE) **112** (This phone number is valid 24h, 7/7)
DENMARK Giftlinjen +45 82 12 12 12

SECTION 1 NOTES: Preleminary MSDS for pilot production sample. The properties of this material have not been fully investigated. Use due caution in handling and use of this material. It's chemical, physical and toxicological properties have not been fully investigated. Exercise due care.

SECTION 2: HAZARDS IDENTIFICATION

2.1 CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

Classification according to Regulation (EC) No 1272/2008.
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410
For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 LABEL ELEMENTS

Labelling according Regulation (EC) No 1272/2008

Signal word Warning
Hazard statement(s)
H410 Very toxic to aquatic life with long lasting effects.
H315 Causes skin irritation.

H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
Precautionary statement(s)
P273 Avoid release to the environment.
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.
Supplemental Hazard
Statements none

2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Component Name:	CAS NO.	Percent
Copper (Cu)	7440-22-4	70-80 wt%
Propyleneglycol	7732-18-5	10-20 wt%
Binder	Proprietary	< 5 wt%
Additives	Proprietary	< 6 wt%

SECTION 3 NOTES: The exact amount of the surfactant has not been quantified properly for this sample

SECTION 4: FIRST AID MEASURES

4.1 Description of first-aid measures
General advice
Show this material safety data sheet to the doctor in attendance.
If inhaled
Remove the victim to fresh air and keep them at rest in a position comfortable for breathing.
If symptoms persist, seek medical attention.
In case of breathing difficulties, administer oxygen if available and call a doctor immediately.
In case of skin contact
Wash the affected area with plenty of soap and water.
Remove and wash contaminated clothing before reuse.
If skin irritation occurs, seek medical advice.
In case of eye contact
Rinse cautiously with water for at least 15 minutes. Remove contact lenses if present and easy to do, then continue rinsing.
If irritation persists, seek medical attention.
If swallowed
Rinse mouth thoroughly with water. Do NOT induce vomiting unless directed by medical personnel.
Call a poison control center or physician immediately for advice.
If the person is unconscious, do not give anything by mouth.
4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
Acute Symptoms:
Inhalation: Irritation of the respiratory tract, coughing, or shortness of breath.
Skin: Irritation, redness, or dryness.
Eyes: Redness, tearing, or irritation.
Ingestion: Nausea, vomiting, or gastrointestinal discomfort.
Delayed Symptoms:
Prolonged exposure may lead to respiratory sensitization or dermatitis.
4.3 Indication of any immediate medical attention and special treatment needed
Seek immediate medical attention if there are severe symptoms such as difficulty breathing, persistent eye irritation, or ingestion of a large quantity.
Physicians should treat symptomatically and be aware of potential copper exposure effects.

SECTION 5: FIRE-FIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
5.2 Special hazards arising from the substance or mixture

Copper oxides
Containers exposed to fire may rupture due to heat.
5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.
Move containers from the fire area if it is safe to do so.
Cool containers exposed to fire with water spray to prevent rupture.
5.4 Further information
No data available

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling Suitable extinguishing media
Provide appropriate exhaust ventilation at places where dust is formed. Normal measures for preventive fire protection. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and cold (< 4 °C) place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.2 Control parameters
Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls
Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. 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. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Impervious clothing recommended. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Do not let product enter drains.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Reddish paste

ODOR: none

PHYSICAL STATE: Paste

pH AS SUPPLIED: N/A

BOILING POINT: N/A
MELTING POINT: N/A
FREEZING POINT: N/A
VAPOR PRESSURE (mmHg):
N/A

VAPOR DENSITY (AIR = 1):
N/A

SPECIFIC GRAVITY (H2O = 1):
@ 20 C 3.3 g/ml

EVAPORATION RATE:

BASIS (=1):

PERCENT SOLIDS BY WEIGHT: 70-80 %

PERCENT VOLATILE:
BY VOL 0

VOLATILE ORGANIC COMPOUNDS (VOC):

WITH WATER: N/A **LBS/GAL**
WITHOUT WATER: N/A **LBS/GAL**

MOLECULAR WEIGHT: N/A
VISCOSITY: 50.000 cp @ 1 s^{-1}

SECTION 9 NOTES: None

SECTION 10: STABILITY AND REACTIVITY

STABILITY:
No specific test data related to reactivity available for this product.

CONDITIONS TO AVOID (STABILITY):
Incompatible materials.

INCOMPATIBILITY (MATERIAL TO AVOID):
Keep away from strong oxidizers, strong bases, strong acids, chlorine

HAZARDOUS DECOMPOSITION OR BY-PRODUCTS:
Cu oxide

HAZARDOUS POLYMERIZATION:
Hazardous polymerization will not occur

CONDITIONS TO AVOID (POLYMERIZATION):
N/A

SECTION 10 NOTES: None

SECTION 11: TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION:

Acute toxicity
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity IARC:
No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: GL5325000
Symptoms of systemic copper poisoning may include: capillary damage, headache, cold sweat, weak pulse, and kidney and liver damage, central nervous system excitation followed by depression, jaundice, convulsions, paralysis, and coma. Death may occur from shock or renal failure. Chronic copper poisoning is typified by hepatic cirrhosis, brain damage and demyelination, kidney defects, and copper deposition in the cornea as exemplified by humans with Wilson's disease. It has also been reported that copper poisoning has lead to hemolytic anemia and accelerates arteriosclerosis, damage to the lungs, vomiting, diarrhea, abdominal pain, blood disorders

SECTION 12: ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish mortality
LOEC - Oncorhynchus mykiss (rainbow trout) - 0,022 mg/l - 96 h
LC50 - Oncorhynchus mykiss (rainbow trout) - 0,15 mg/l - 96 h

Toxicity to daphnia and other aquatic invertebrates mortality
NOEC - Daphnia (water flea) - 0,004 mg/l - 24 h
EC50 - Daphnia magna (Water flea) - 0,04 - 0,05 mg/l - 48 h

12.2 Persistence and degradability
Not applicable

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Other adverse effects
Very toxic to aquatic life.
No data available

SECTION 13: DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD:
Consult federal, state and local waste regulations to determine appropriate disposal options.
DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER.

SECTION 13 NOTES: None

SECTION 14: TRANSPORT INFORMATION

International transport regulations
14.1 UN number:
ADR/RID: UN 3077 **IMDG:** UN 3077 **IATA:** UN 3077
14.2 Proper shipping name:
ADR/RID: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Contains Copper)
IMDG: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Contains Copper)
IATA: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Contains Copper)
14.3 Transport hazard class(es)
ADR/RID: 9 **IMDG:** 9 **IATA:** 9
14.4 Packing group
ADR/RID: III **IMDG:** III **IATA:** III
14.5 Environmental hazard
Marine Pollutant: Yes
14.6 Special precautions for user
None known
14.7 Transport to bulk according to Annex II of MARPOL and the IBC Code
Not applicable

SECTION 15: REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS

TSCA (TOXIC SUBSTANCE CONTROL ACT): All components are Listed

313 REPORTABLE INGREDIENTS: NONE

SECTION 15 NOTES: None

SECTION 16: OTHER INFORMATION

OTHER INFORMATION:

Full text of H-statements referred to in section 2

H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects

PREPARATION INFORMATION:
Revision Summary: Rev 1.0 is initial version released 2022.10.21.

DISCLAIMER:
DTI urges each customer or recipient of this MSDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this MSDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above but DTI makes no representation as to its comprehensiveness or accuracy. No warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that its activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. The information contained in this MSDS sheet does not constitute a hazard assessment and should not be used in place of the user's own assessment of work place risks as required by other health and safety legislation. It is the user's responsibility to determine the suitability of this product, data and the information with the applicable laws and regulations.