

Safety Data Sheet

According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations And According To The Hazardous Products Regulation (February 11, 2015).

Date of Issue: 12/06/2019 Version: 1.0

SECTION 1: IDENTIFICATION

1.1. Product Identifier

Product Form: Mixture **Product Name:** Copper

1.2. Intended Use of the Product

MarkForged 3D printing material.

1.3. Name, Address, and Telephone of the Responsible Party

Company

MarkForged, Inc 85 School St

Watertown MA 02472

T: 844-700-1035 (9:00 A.M to 6:00 P.M. EST)

support@markforged.com www.markforged.com

1.4. Emergency Telephone Number

Emergency Number : +1 703-741-5970 / 1-800-424-9300 (Chemtrec)

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the Substance or Mixture

GHS-US/CA Classification

Not classified

2.2. Label Elements

GHS-US/CA Labeling

No labeling applicable according to 29 CFR 1910.1200 and the Hazardous Products Regulations (HPR) SOR/2015-17.

2.3. Other Hazards

Exposure may aggravate pre-existing eye, skin, or respiratory conditions. During processing, the most significant route of exposure is by the inhalation (breathing) of fumes. If fumes are inhaled, they can cause a condition commonly known as metal fume fever with symptoms which resemble influenza; Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Due to the product's final form, combustible dusts are not likely to be generated.

2.4. Unknown Acute Toxicity (GHS-US/CA)

No data available

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substance

Not applicable

3.2. Mixture

Name	Product Identifier	% *	GHS Ingredient Classification
Copper	(CAS-No.) 7440-50-8	84.92 - 94.36	Not classified

Full text of H-phrases: see section 16

SECTION 4: FIRST AID MEASURES

4.1. Description of First-aid Measures

General: Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

12/06/2019 EN (English US) 1/7

^{*}Percentages are listed in weight by weight percentage (w/w%) for liquid and solid ingredients. Gas ingredients are listed in volume by volume percentage (v/v%).

Safety Data Sheet

According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations And According To The Hazardous Products Regulation (February 11, 2015).

Inhalation: When symptoms occur: go into open air and ventilate suspected area. Obtain medical attention if breathing difficulty persists.

Skin Contact: Remove contaminated clothing. Drench affected area with water for at least 5 minutes. Cool skin rapidly with cold water after contact with molten product. Removal of solidified molten material from skin requires medical assistance.

Eye Contact: Rinse cautiously with water for at least 5 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical attention if irritation develops or persists. Removal of solidified molten material from the eyes requires medical assistance.

Ingestion: Rinse mouth. Do NOT induce vomiting. Obtain medical attention.

4.2. Most Important Symptoms and Effects Both Acute and Delayed

General: Not expected to present a significant hazard under anticipated conditions of normal use. Prolonged contact with large amounts of dust may cause mechanical irritation. Risk of thermal burns on contact with molten product.

Inhalation: Not expected to present a significant inhalation hazard under anticipated conditions of normal use. Repeated or prolonged exposure to dust particles may result in fibrosis (Pneumoconiosis). During processing, the most significant route of exposure is by the inhalation (breathing) of fumes. If fumes are inhaled, they can cause a condition commonly known as metal fume fever with symptoms which resemble influenza; Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur.

Skin Contact: Prolonged exposure may cause skin irritation. Risk of thermal burns on contact with molten product.

Eye Contact: May cause slight irritation to eyes. Risk of thermal burns on contact with molten product.

Ingestion: Ingestion may cause adverse effects.

Chronic Symptoms: None expected under normal conditions of use. In massive form, no chronic hazard exists. If physically altered to present slivers, ribbons, dusts or fumes from molten material: Copper: Overexposure to fumes may cause metal fume fever (chills, muscle aches, nausea, fever, dry throat, cough, weakness, lassitude); metallic or sweet taste; discoloration of skin and hair. Tissue damage of mucous membranes may follow chronic dust exposure.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed

If exposed or concerned, get medical advice and attention. If medical advice is needed, have product container or label at hand.

SECTION 5: FIRE-FIGHTING MEASURES

5.1. Extinguishing Media

Suitable Extinguishing Media: Dry sand; Class D Extinguishing Agent (for metal powder fires).

Unsuitable Extinguishing Media: Do not use direct water on the burning/molten product; they could cause a steam explosion and spread of the fire. Do not use a heavy water stream. Use of heavy stream of water may spread fire.

5.2. Special Hazards Arising From the Substance or Mixture

Fire Hazard: Not considered flammable but may burn at high temperatures.

Explosion Hazard: Product itself is not explosive but if dust is generated, dust clouds suspended in air can be explosive.

Reactivity: Stable at ambient temperature and under normal conditions of use. Hazardous reactions will not occur under normal conditions.

5.3. Advice for Firefighters

Precautionary Measures Fire: Exercise caution when fighting any chemical fire.

Firefighting Instructions: Use water spray or fog for cooling exposed containers. Do not breathe fumes from fires or vapors from decomposition.

Protection During Firefighting: Do not enter fire area without proper protective equipment, including respiratory protection.

Hazardous Combustion Products: Metal oxides. Carbon oxides (CO, CO₂). Unidentified organic compounds.

Other Information: Do not add water to molten material as this may cause spattering.

5.4. Reference to Other Sections

Refer to Section 9 for flammability properties.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal Precautions, Protective Equipment and Emergency Procedures

General Measures: Avoid prolonged contact with eyes, skin and clothing. Avoid breathing dust.

6.1.1. For Non-Emergency Personnel

Protective Equipment: Use appropriate personal protective equipment (PPE).

12/06/2019 EN (English US) 2/7

Safety Data Sheet

According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations And According To The Hazardous Products Regulation (February 11, 2015).

Emergency Procedures: Evacuate unnecessary personnel.

6.1.2. For Emergency Personnel

Protective Equipment: Equip cleanup crew with proper protection.

Emergency Procedures: Upon arrival at the scene, a first responder is expected to recognize the presence of dangerous goods, protect oneself and the public, secure the area, and call for the assistance of trained personnel as soon as conditions permit. Ventilate area.

6.2. Environmental Precautions

Prevent entry to sewers and public waters.

6.3. Methods and Materials for Containment and Cleaning Up

For Containment: Contain solid spills with appropriate barriers and prevent migration and entry into sewers or streams.

Methods for Cleaning Up: Clean up spills immediately and dispose of waste safely. Cool molten material to limit spreading. Utilize a dust suppressant when removing mechanically. Recover the product by vacuuming, shoveling or sweeping. Transfer spilled material to a suitable container for disposal. Contact competent authorities after a spill.

6.4. Reference to Other Sections

See Section 8 for exposure controls and personal protection and Section 13 for disposal considerations.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for Safe Handling

Additional Hazards When Processed: Contains substances that are combustible dusts. If the material is further processed and dust is allowed to accumulate, may form combustible dust concentrations in air that could ignite and cause an explosion. Molten metal and water can be an explosive combination.

Precautions for Safe Handling: Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Avoid prolonged contact with eyes, skin and clothing. Avoid breathing dust.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety procedures. Wash contaminated clothing before reuse.

7.2. Conditions for Safe Storage, Including Any Incompatibilities

Technical Measures: Comply with applicable regulations.

Storage Conditions: Keep container closed when not in use. Store in a dry, cool place. Keep/Store away from direct sunlight, extremely high or low temperatures and incompatible materials.

Incompatible Materials: Strong acids, strong bases, strong oxidizers. Corrosive substances in contact with metals may produce flammable hydrogen gas.

7.3. Specific End Use(s)

MarkForged 3D printing material.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control Parameters

For substances listed in section 3 that are not listed here, there are no established exposure limits from the manufacturer, supplier, importer, or the appropriate advisory agency including: ACGIH (TLV), AIHA (WEEL), NIOSH (REL), OSHA (PEL), or Canadian provincial governments.

Copper (7440-50-8)		
USA ACGIH	ACGIH TWA (mg/m³)	0.2 mg/m³ (fume)
USA OSHA	OSHA PEL (TWA) (mg/m³)	0.1 mg/m³ (fume)
		1 mg/m³ (dust and mist)
USA NIOSH	NIOSH REL (TWA) (mg/m³)	1 mg/m³ (dust and mist)
		0.1 mg/m³ (fume)
USA IDLH	US IDLH (mg/m³)	100 mg/m³ (dust, fume and mist)
Alberta	OEL TWA (mg/m³)	0.2 mg/m³ (fume)
		1 mg/m³ (dust and mist)
British Columbia	OEL TWA (mg/m³)	1 mg/m³ (dust and mist)
		0.2 mg/m³ (fume)
Manitoba	OEL TWA (mg/m³)	0.2 mg/m³ (fume)
New Brunswick	OEL TWA (mg/m³)	0.2 mg/m³ (fume)
		1 mg/m³ (dust and mist)
Newfoundland & Labrador	OEL TWA (mg/m³)	0.2 mg/m³ (fume)

12/06/2019 EN (English US) 3/7

Safety Data Sheet
According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations And According To The Hazardous Products Regulation (February 11, 2015).

Tieser unig 10 1 euerus riegistes / 10m 77/10	o. 50 / Monday, March 20, 2012 / Raics / Ma Regulations	And According to the Hazardous Products Regulation (February 11, 2015).
Nova Scotia	OEL TWA (mg/m³)	0.2 mg/m³ (fume)
Nunavut	OEL STEL (mg/m³)	3 mg/m³ (dust and mist)
		0.6 mg/m³ (fume)
Nunavut	OEL TWA (mg/m³)	0.2 mg/m³ (fume)
		1 mg/m³ (dust and mist)
Northwest Territories	OEL STEL (mg/m³)	3 mg/m³ (dust and mist)
		0.6 mg/m³ (fume)
Northwest Territories	OEL TWA (mg/m³)	0.2 mg/m³ (fume)
		1 mg/m³ (dust and mist)
Ontario	OEL TWA (mg/m³)	0.2 mg/m³ (fume)
		1 mg/m³ (dust and mist)
Prince Edward Island	OEL TWA (mg/m³)	0.2 mg/m³ (fume)
Québec	VEMP (mg/m³)	0.2 mg/m³ (fume)
		1 mg/m ³ (dust and mist)
Saskatchewan	OEL STEL (mg/m³)	0.6 mg/m³ (fume)
	, ,	3 mg/m³ (dust and mist)
Saskatchewan	OEL TWA (mg/m³)	0.2 mg/m³ (fume)
		1 mg/m³ (dust and mist)
Yukon	OEL STEL (mg/m³)	0.2 mg/m³ (fume)
	, ,	2 mg/m³ (dust and mist)
Yukon	OEL TWA (mg/m³)	0.2 mg/m³ (fume)
		1 mg/m³ (dust and mist)
Particulates not otherwise	classified (PNOC)	
USA ACGIH	ACGIH TWA (mg/m³)	3 mg/m ³ Respirable fraction
	, ,	10 mg/m ³ Total Dust
USA OSHA	OSHA PEL (TWA) (mg/m³)	5 mg/m ³ Respirable fraction
	, , , ,	15 mg/m³ Total Dust
Alberta	OEL TWA (mg/m³)	10 mg/m³ (total)
	, 3, ,	3 mg/m³ (respirable)
British Columbia	OEL TWA (mg/m³)	10 mg/m³ (nuisance dust-total dust)
		3 mg/m³ (nuisance dust-respirable fraction)
Manitoba	OEL TWA (mg/m³)	10 mg/m³ (inhalable particles, recommended)
		3 mg/m³ (respirable particles, recommended)
New Brunswick	OEL TWA (mg/m³)	3 mg/m³ (particulate matter containing no Asbestos and
		<1% Crystalline silica, respirable fraction)
		10 mg/m³ (particulate matter containing no Asbestos and
		<1% Crystalline silica, inhalable fraction)
Newfoundland & Labrador	OEL TWA (mg/m³)	10 mg/m³ (inhalable particles, recommended)
		3 mg/m³ (respirable particles, recommended)
Nova Scotia	OEL TWA (mg/m³)	10 mg/m³ (inhalable particles, recommended)
		3 mg/m³ (respirable particles, recommended)
Nunavut	OEL STEL (mg/m³)	20 mg/m³ (insoluble or poorly soluble-inhalable fraction)
		6 mg/m³ (insoluble or poorly soluble-respirable fraction)
Nunavut	OEL TWA (mg/m³)	10 mg/m³ (insoluble or poorly soluble-inhalable fraction)
		3 mg/m³ (insoluble or poorly soluble-respirable fraction)
Northwest Territories	OEL STEL (mg/m³)	20 mg/m³ (insoluble or poorly soluble-inhalable fraction)
		6 mg/m³ (insoluble or poorly soluble-respirable fraction)
Northwest Territories	OEL TWA (mg/m³)	10 mg/m³ (insoluble or poorly soluble-inhalable fraction)
		3 mg/m³ (insoluble or poorly soluble-respirable fraction)
Ontario	OEL TWA (mg/m³)	10 mg/m³ (inhalable)
		3 mg/m³ (respirable)
Prince Edward Island	OEL TWA (mg/m³)	10 mg/m³ (inhalable particles, recommended)
		3 mg/m³ (respirable particles, recommended)

12/06/2019 EN (English US)

Safety Data Sheet

According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations And According To The Hazardous Products Regulation (February 11, 2015).

Québec	VEMP (mg/m³)	10 mg/m³ (including dust, inert or nuisance particulates-
		total dust)
Saskatchewan	OEL STEL (mg/m³)	20 mg/m³ (insoluble or poorly soluble-inhalable fraction)
		6 mg/m³ (insoluble or poorly soluble-respirable fraction)
Saskatchewan	OEL TWA (mg/m³)	10 mg/m³ (insoluble or poorly soluble-inhalable fraction)
		3 mg/m³ (insoluble or poorly soluble-respirable fraction)

8.2. Exposure Controls

Appropriate Engineering Controls: Suitable eye/body wash equipment should be available in the vicinity of any potential exposure. Ensure adequate ventilation, especially in confined areas. Ensure all national/local regulations are observed. Use local exhaust or general dilution ventilation or other suppression methods to maintain dust levels below exposure limits. Power equipment should be equipped with proper dust collection devices. It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product contain explosion relief vents or an explosion suppression system or an oxygen-deficient environment.

Personal Protective Equipment: Gloves. Protective clothing. Protective goggles.







Materials for Protective Clothing: Chemically resistant materials and fabrics.

Hand Protection: Wear protective gloves.

Eye and Face Protection: Chemical safety goggles.

Skin and Body Protection: Wear suitable protective clothing.

Respiratory Protection: If exposure limits are exceeded or irritation is experienced, approved respiratory protection should be worn. In case of inadequate ventilation, oxygen deficient atmosphere, or where exposure levels are not known wear approved respiratory protection.

Other Information: When using, do not eat, drink or smoke.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on Basic Physical and Chemical Properties		
Physical State	:	Solid
Appearance	:	Not available
Odor	:	Not available
Odor Threshold	:	Not available
pH	:	Not available
Evaporation Rate	:	Not available
Melting Point	:	Not available
Freezing Point	:	Not available
Boiling Point	:	Not available
Flash Point	:	Not available
Auto-ignition Temperature	:	Not available
Decomposition Temperature	:	Not available
Flammability (solid, gas)	:	Not available
Lower Flammable Limit	:	Not available
Upper Flammable Limit	:	Not available
Vapor Pressure	:	Not available
Relative Vapor Density at 20°C	:	Not available
Relative Density	:	Not available
Specific Gravity	:	Not available
Solubility	:	Not available
Partition Coefficient: N-Octanol/Water	:	Not available
Viscosity	:	Not available

12/06/2019 EN (English US) 5/7

Safety Data Sheet

According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations And According To The Hazardous Products Regulation (February 11, 2015).

SECTION 10: STABILITY AND REACTIVITY

- **10.1. Reactivity:** Stable at ambient temperature and under normal conditions of use. Hazardous reactions will not occur under normal conditions.
- **10.2.** Chemical Stability: Stable under recommended handling and storage conditions (see section 7).
- **10.3.** Possibility of Hazardous Reactions: Hazardous polymerization will not occur.
- **10.4. Conditions to Avoid:** Direct sunlight, extremely high or low temperatures, and incompatible materials. Dust accumulation (to minimize explosion hazard).
- **10.5. Incompatible Materials:** Strong acids, strong bases, strong oxidizers. Corrosive substances in contact with metals may produce flammable hydrogen gas.
- **10.6. Hazardous Decomposition Products:** None expected under normal conditions of use. Thermal decomposition generates : Metal oxides.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on Toxicological Effects - Product

Acute Toxicity (Oral): Not classified
Acute Toxicity (Dermal): Not classified
Acute Toxicity (Inhalation): Not classified
LD50 and LC50 Data: Not available
Skin Corrosion/Irritation: Not classified
Eye Damage/Irritation: Not classified

Respiratory or Skin Sensitization: Not classified

Germ Cell Mutagenicity: Not classified

Carcinogenicity: Not classified

Specific Target Organ Toxicity (Repeated Exposure): Not classified

Reproductive Toxicity: Not classified

Specific Target Organ Toxicity (Single Exposure): Not classified

Aspiration Hazard: Not classified

Symptoms/Injuries After Inhalation: Not expected to present a significant inhalation hazard under anticipated conditions of normal use. Repeated or prolonged exposure to dust particles may result in fibrosis (Pneumoconiosis). During processing, the most significant route of exposure is by the inhalation (breathing) of fumes. If fumes are inhaled, they can cause a condition commonly known as metal fume fever with symptoms which resemble influenza; Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur.

Symptoms/Injuries After Skin Contact: Prolonged exposure may cause skin irritation. Risk of thermal burns on contact with molten product.

Symptoms/Injuries After Eye Contact: May cause slight irritation to eyes. Risk of thermal burns on contact with molten product. **Symptoms/Injuries After Ingestion:** Ingestion may cause adverse effects.

Chronic Symptoms: None expected under normal conditions of use. In massive form, no chronic hazard exists. If physically altered to present slivers, ribbons, dusts or fumes from molten material: Copper: Overexposure to fumes may cause metal fume fever (chills, muscle aches, nausea, fever, dry throat, cough, weakness, lassitude); metallic or sweet taste; discoloration of skin and hair. Tissue damage of mucous membranes may follow chronic dust exposure.

11.2. Information on Toxicological Effects - Ingredient(s)

LD50 and LC50 Data: Not available

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity

Ecology - General: Not classified. This product contains components that are environmentally hazardous and small chips and dust from processing may be very toxic to aquatic life and harmful to aquatic life with long lasting effects.

12.2. Persistence and Degradability

Copper

12/06/2019 EN (English US) 6/7

Safety Data Sheet

According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations And According To The Hazardous Products Regulation (February 11, 2015).

Persistence and Degradability	Not established.
Copper (7440-50-8)	
Persistence and Degradability	Not readily biodegradable.

12.3. Bioaccumulative Potential

Copper	
Bioaccumulative Potential	Not established.

12.4. Mobility in Soil Not available

12.5. Other Adverse Effects

Other Information: Avoid release to the environment.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Waste Disposal Recommendations: Dispose of contents/container in accordance with local, regional, national, and international regulations

Ecology - Waste Materials: Avoid release to the environment.

SECTION 14: TRANSPORT INFORMATION

The shipping description(s) stated herein were prepared in accordance with certain assumptions at the time the SDS was authored, and can vary based on a number of variables that may or may not have been known at the time the SDS was issued.

14.1. In Accordance with DOT
 14.2. In Accordance with IMDG
 14.3. In Accordance with IATA
 14.4. In Accordance with TDG
 Not regulated for transport
 Not regulated for transport
 Not regulated for transport

SECTION 15: REGULATORY INFORMATION

15.1. US Federal Regulations

Copper (7440-50-8)	
Listed on the United States TSCA (Toxic Substances	Control Act) inventory
Subject to reporting requirements of United States	SARA Section 313
CERCLA RQ	5000 lb no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is
	>100 μm
SARA Section 313 - Emission Reporting	1 %

15.2. US State Regulations

Copper (7440-50-8)

- U.S. Massachusetts Right To Know List
- U.S. New Jersey Right to Know Hazardous Substance List
- U.S. Pennsylvania RTK (Right to Know) Environmental Hazard List
- U.S. Pennsylvania RTK (Right to Know) List

15.3. Canadian Regulations

Copper (7440-50-8)	
Listed on the Canadian DSL (Domestic Substances List	٠١

SECTION 16: OTHER INFORMATION, INCLUDING DATE OF PREPARATION OR LAST REVISION

Date of Preparation or Latest

st

: 12/06/2019

Revision

Other Information

: This document has been prepared in accordance with the SDS requirements of the OSHA Hazard Communication Standard 29 CFR 1910.1200 and Canada's Hazardous Products

Regulations (HPR) SOR/2015-17.

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as quaranteeing any specific property of the product.

12/06/2019 EN (English US) 7/7

NA GHS SDS 2015 (Can, US)