

SECTION 1 - IDENTIFICATION

COMPANY ADDRESS:

The Virtual Foundry, Inc
211 S Water St
Stoughton, WI 53589
USA

PRODUCT NAME: **Stainless Steel 17-4 Filamet™**

PRODUCT USE: Manufacture of metal parts by extrusion, injection-molding, or 3D printing.

SECTION 2 - HAZARDS IDENTIFICATION SUMMARY

(As defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200)

CARCINOGENICITY - Category 2

Percentage of the mixture consisting of ingredient(s) of unknown oral toxicity 21%
Percentage of the mixture consisting of ingredient(s) of unknown dermal toxicity: 21%
Percentage of the mixture consisting of ingredient(s) of unknown inhalation toxicity. 21 %



PHYSICAL HAZARDS: If exposed or concerned get medical attention. Contact with product at elevated temperatures can result in thermal burns. Inhalation of dusts and vapors of melted material from this product may cause irritation of the eyes, nose, throat and respiratory system. May cause coughing or shortness of breath. Mechanical eye irritant. May cause tearing and redness. Mechanical skin irritant. Prolonged contact may cause skin abrasion, redness, itching. Irritating to the respiratory tract. Large overdoses may cause nervous system disturbances, and diarrhea. May cause nausea and vomiting. No long-term health effects are anticipated.

HAZARD STATEMENTS: Warning, suspected of causing cancer. Irritating to eyes and respiratory tract. Exposure may include persistent cough, shortness of breath.

OTHER HAZARDS: If small particles are generated during further processing, handling, or by other means, combustible dust concentrations in air may form.

SECTION 3 - COMPOSITION, INFORMATION OF INGREDIENTS

| Metal | CAS No. | %by Weight |
|----------|-----------|---------------|
| Iron | 7439-89-6 | ≥75.0 - ≤90.0 |
| Chromium | 7440-47-3 | ≥10.0 - ≤25.0 |
| Nickel | 7440-02-0 | ≤5.0 |

| | | |
|---|----------------|-------------------|
| Copper | 7440-50-8 | ≤5.0 |
| Niobium | 7440-03-1 | ≤1.0 |
| Silicon | 7440-21-3 | <1.0 |
| Chemical Name | CAS No. | %by Weight |
| 2-Propenenitrile, polymer with 1,3-butadiene and ethenylbenzene | 9003-56-9 | trace |
| Binding Additive | Proprietary | trace |
| Polylactic Acid | 9051-89-2 | <20% |

SECTION 4 - FIRST AID MEASURES

IF SWALLOWED: Ingestion is an unlikely route of exposure. Wash out your mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in the recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt, or waistband. Call a poison control center or doctor immediately for treatment advice. Do not induce vomiting unless told to do so by the poison control center or consult a doctor if necessary. Seek immediate medical attention.

IF ON SKIN OR CLOTHING: Immediately flush with plenty of water for at least 15 minutes. Remove contaminated clothing. Wash skin using soap. Get medical attention if symptoms persist. Cool skin rapidly with cold water after contact with hot polymer. DO NOT attempt to remove hot polymer from skin or contaminated clothing as skin may be easily damaged. If skin irritation persists, call a physician.

IF IN EYES: Flush eyes with large volumes of water for at least 15 minutes lifting upper and lower eyelids occasionally. Seek medical attention if irritation develops.

IF INHALED: Remove to fresh air. Lay patient down. Cover with a blanket. If symptoms persist, call a physician. If a person is not breathing, call 911 or an ambulance, then provide medical aid.

MAIN SYMPTOMS: Redness, coughing and/or wheezing.

NOTE TO PHYSICIAN: Treat symptomatically.

SECTION 5 - FIRE FIGHTING MEASURES

FLAMMABILITY

AUTOIGNITION TEMPERATURE: 388°C

SUITABLE EXTINGUISHING MEDIA: Use foam, Carbon Dioxide (CO₂), dry chemical, alcohol

resistant foams (preferred if available). General-purpose synthetic foams (including AFFF) or protein foams may function, but much less effectively.

UNSUITABLE EXTINGUISHING MEDIA: Do not use a solid water stream as it may scatter and spread fire.

SPECIFIC HAZARDS ARISING FROM THE CHEMICAL: Thermal decomposition can lead to release of irritating gasses, vapors, and metal oxide/oxides. Do not breathe fumes in case of fire.

HAZARDOUS COMBUSTION PRODUCTS: Carbon oxides Nitrogen oxides (NOx) Hydrocarbons.

EXPLOSION DATA

SENSITIVITY TO MECHANICAL IMPACT: Not sensitive.

SENSITIVITY TO STATIC DISCHARGE: Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

FIRE FIGHTING INSTRUCTIONS AND FIRE FIGHTING EQUIPMENT: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode (MSHA/NIOSH approved or equivalent) and full protective gear. Cool containers / tanks with water spray. Water mist may be used to cool closed containers.

ADDITIONAL INFORMATION: No information available.

PERSONAL PROTECTIVE EQUIPMENT: Wear self-contained breathing apparatus.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS: Ensure adequate ventilation. Standard personal protection equipment (PPE). Avoid contact with skin and eyes. Avoid dust formation.

ENVIRONMENTAL PRECAUTIONS: Avoid dispersal of spilled material, runoff and contact with soil, waterways, drains, and sewers. Should not be released into the environment, may be dangerous to birds and small animals. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

METHODS FOR CLEANING UP: Vacuum or carefully scoop up spilled material and place in an appropriate container for disposal. Avoid creating dusty conditions and prevent wind dispersal. Ventilate the area through non-mechanical means (e.g. opening a window). Take care not to raise dust. Use non-sparking tools. Clean up using methods which avoid dust generation such as vacuuming (with appropriate filter to prevent airborne dust levels which exceed the TLV), wet dust mop or wet clean up. If airborne dust is generated, use an appropriate NIOSH-approved respirator.

SECTION 7 - HANDLING AND STORAGE

HANDLING: Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle it until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not ingest.

Avoid breathing dust. If during normal use the material presents a respiratory hazard. use only with adequate ventilation or wear appropriate respirator.

STORAGE: Use personal protective equipment. Workers should be protected from the possibility of contact with molten material during fabrication. Avoid contact with eyes. Low hazard for usual industrial or commercial handling. Avoid dust formation. Wash hands before eating. Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash their hands and face before eating. drinking and smoking Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS

| Metal | CAS No. | %by Weight | ACGIH TLV (Mg/M³) | OSHA PEL (Mg/M³) |
|--------------|----------------|-------------------|-------------------------------------|------------------------------------|
| Iron | 7439-89-6 | ≥75.0 - ≤90.0 | - | - |
| Chromium | 7440-47-3 | ≥10.0 - ≤25.0 | 0.5 mg/m ³ | 1 mg/m ³ |
| Nickel | 7440-02-0 | ≤5.0 | 1.5 mg/m ³ | 1 mg/m ³ |
| Copper | 7440-50-8 | ≤5.0 | 1.0 mg/m ³ | - |
| Niobium | 7440-03-1 | ≤1.0 | - | - |
| Silicon | 7440-21-3 | <1.0 | - | 15 mg/m ³ |

| COMPONENT | OSHA PEL | ACGIH TLV | NIOSH IDLH |
|---|-----------------|------------------|-------------------|
| 2-Propenenitrile, polymer with 1,3-butadiene and ethenylbenzene 9003-56-9 | - | - | - |

TLV: Threshold Limit Value over 8 hours of work.

PEL: Permissible Exposure Limit

ADDITIONAL PROTECTION: Provide eyewash station and washing facilities accessible to areas of use and handling.

ENGINEERING CONTROLS

Engineering Measures: Apply technical measures to comply with the occupational exposure limits. Where reasonably practicable this should be achieved by the use of local exhaust ventilation and good

general extraction. Provide appropriate exhaust ventilation at places where dust is formed. Provide sufficient mechanical ventilation to reduce airborne concentrations and minimize exposure. Maintain employee exposure below applicable permissible exposure limits.

EXPOSURE MONITORING

Exposure Limits: See table above.

Hygiene Measures: Avoid contact with eyes.

PERSONAL PROTECTIVE EQUIPMENT

Eye protection: Avoid eye contact. To minimize the risk of injury to eyes, always wear appropriate protective safety glasses, side-shields or chemical safety goggles.

Skin protection: Avoid skin contact with molten polymer. Wear appropriate protective clothing to minimize risk of injury to the skin from contact with dust or physical abrasion. Long sleeved/impervious clothing if contact is probable and skin is sensitive. Protect contact with skin when processing; while material is hot, wear insulated safety gloves; wash hands after handling. Coveralls should be made from fire resistive materials which tend to not accumulate static charges. They should be designed in such a way as to avoid accumulation of dust in cuffs, pockets, etc.

Respiratory protection: Respirator must be worn if exposed to dust. Wear a respirator with a dust filter.

Respiratory protection is needed if any of the exposure limits in Section 3 are exceeded. Consult an industrial hygiene professional prior to respirator selection and use. Use a positive-pressure air supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air-purifying respirators may not provide adequate protection. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Hand protection: While material is hot, wear insulated safety gloves; wash hands after handling.

Hygiene measures: Provide regular cleaning of equipment, work area and clothing. Handle in accordance with good industrial hygiene and safety practices. Do not eat, drink or smoke when using this product. Wash hands before breaks and immediately after handling the product. Avoid contact with eyes. Do not breathe dust. Use personal protective equipment as required.

Special hazard: Workers should be protected from the possibility of contact with molten material during fabrication.

Environmental Protection: Do not allow to enter drains or watercourses.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

| | |
|------------------------|-------------------|
| Physical State: | Solid |
| Appearance: | Filament, Pellets |
| Color: | Gray |
| Odor: | Slight |

| | |
|--|---|
| Odor Threshold: | No information available. |
| Melting/Freezing Point: | 150-180°C (302- 356°F) |
| Boiling Point: | No information available. |
| Flash Point: | No information available. |
| Evaporation Rate: | No information available. |
| Flammability: | No information available. |
| Flammability Limits: | No information available. |
| Vapor Pressure: | Not applicable |
| Vapor Density: | Not applicable |
| Specific gravity: | No information available. |
| Relative Density: | No information available. |
| Water Solubility: | Negligible (<0.1%), Insoluble in cold and hot water |
| Percent Volatile (v/v): | 0% |
| Chemical Stability: | No information available. |
| Conditions to avoid: | No information available. |
| Solubility in other solvents: | Insoluble |
| Partition Coefficient: | No information available. |
| Auto-Ignition Temperature: | 388°C |
| Hazardous Decomposition Products: | No information available. |
| Possibility of Hazardous Reactions: | No information available. |
| Hazardous Polymerization: | No information available. |
| Decomposition Temperature: | 250°C |
| Viscosity: | No information available. |
| Explosive Properties: | No information available. |
| Oxidizing Properties: | No information available. |
| Other Information: | |
| Softening Point: | 80-100°C |
| VOC Content (%) | negligible |

| | |
|---------------|---------------------------|
| Bulk Density: | No information available. |
| MEC: | No information available. |
| MIE: | No information available. |
| KST: | No information available. |
| MIT (layer): | No information available. |

SECTION 10 - STABILITY AND REACTIVITY

INCOMPATIBILITY: No information available.

CHEMICAL STABILITY: Stable under recommended storage conditions.

HAZARDOUS POLYMERIZATION: Will not undergo hazardous polymerization.

CONDITIONS & MATERIALS TO AVOID: Avoid keeping resin molten for excessive periods of time at elevated temperatures. Prolonged exposure will cause polymer degradation. Dust formation. Oxidizing agents/materials, Strong bases. Incompatible with strong oxidizing agents and halogens.

HAZARDOUS DECOMPOSITION PRODUCTS: Burning produces noxious and toxic fumes, Carbon monoxide (CO), Carbon Dioxide (CO₂). Exothermic reaction with water, acids, alkalis, to generate hydrogen and heat.

SECTION 11 - TOXICOLOGICAL INFORMATION

Principal routes of exposure: Skin contact.

PRODUCT INFORMATION:

Acute toxicity: None established.

Chronic toxicity: None established.

Specific effects: Inhalation of dust may cause shortness of breath, tightness of chest, a sore throat and cough. Ingestion may cause gastrointestinal irritation. Product dust may be irritating to the eyes.

Long term toxicity: None established.

Mutagenic effects: None established.

Reproductive toxicity: None established.

Carcinogenic effects: This product contains one or more substances which are classified by IARC as carcinogenic to humans (Group I), probably carcinogenic to humans (Group 2A) or possibly carcinogenic to humans (Group 2B).

| COMPONENT | ACGIH | IARC | NTP | OSHA |
|--|-------|---------|-----|------|
| 2-Propenenitrile, polymer with 1,3-butadiene and ethenylbenzene 9003-56-9 | - | Group 3 | - | -- |

Target organ effects: Eyes, Respiratory system.

Ingestion: May cause gastrointestinal discomfort if consumed in large amounts. Not an expected route of exposure.

Inhalation: Inhalation of dust in high concentration may cause irritation of the respiratory system.

Eye Contact: Dust contact with the eyes can lead to mechanical irritation.

Symptoms related to the physical, chemical, and toxicological characteristics: Redness. Coughing and/or wheezing.

Delayed and immediate effects and also chronic effects from short and long term exposure:

Irritation: Product dust may be irritating to eyes, skin, and respiratory system.

SECTION 12 - ECOLOGICAL INFORMATION

Toxicity:

| Product | Result | Species | Exposure |
|----------|--|--|----------|
| Iron | Acute ECS0 3700 mg/l Fresh water | Aquatic plants - Lemna minor | 4 days |
| | Acute LCS0 33000 to 100000 mg/l Marine water | Crustaceans - Crangon crangon | 48 hours |
| | Acute LCS0 6.48 mg/l Marine water | Fish - Periophthalmus waltoni - Adult | 96 hours |
| | Chronic NOEC 100 mg/l Marine water | Algae - Glenodiniumum halli | 72 hours |
| Chromium | Acute ECS0 0.2 ppm Marine water | Algae - Bacillariophyta | 72 hours |
| | Acute ECS0 5 ppm Marine water | Algae - Macrocystis pynfera - Young | 4 days |
| | Acute ECS0 35000 | Aquatic plants - Lemna | 4 days |

| | | | |
|--------|------------------------------------|--|----------|
| | mg/l Fresh water | minor | |
| | Acute LC50 45 mg/l Fresh water | Crustaceans. Ceriodaphnia reticulata | 48 hours |
| | Acute LC50 22 mg/l Fresh water | Daphnia - Daphnia magna | 48 hours |
| | Acute LCS0 13.9 ppm Fresh water | Fish - Anguilla rostrata | 96 hours |
| | Chronic NOEC 50 mg/l Marine water | Algae - Glenodinium halli | 72 hours |
| | Chronic NOEC 0.19 mg/l Fresh water | Fish - Cyprinus carpio | 4 weeks |
| Nickel | Acute ECS0 2 ppm Marine water | Algae - Macrocystis pynfera - Young | 4 days |
| | Acute EC50 450 mg/l Fresh water | Aquatic plants - Lemna minor | 4 days |
| | Acute ECS0 1000 mg/l Marine water | Daphnia- Oaphma magna | 48 hours |
| | Acute IC50 0.31 mg/l Marine water | Crustaceans - Americamysis Bahia - Juvenile (Fledgling, Hatchling, Weanling) | 48 hours |
| | Acute LC50 47.5 mg/l Fresh water | Fish - Heteropneustes fossilis | 96 hours |
| | Chronic NOEC 100 mg/l Marine water | Algae - Glenodinium halli | 72 hours |
| | Chronic NOEC 3.5 mg/l Fresh water | Fish - Cyprinus carpio | 4 weeks |
| Copper | Acute EC50 1100 mg/l Fresh water | Aquatic plants - Lemna minor | 4 days |
| | Acute ECS0 2.1 mg/l Fresh water | Daphnia - Daphnia longispina - Juvenile (Fledgling, Hatchling, Weanling) | 48 hours |
| | Acute ICS0 13 mg/l Fresh water | Algae - Pseudokirchneriella subcapitata - | 72 hours |

| | | | |
|--|---------------------------------------|---|----------|
| | | Exponential growth phase | |
| | Acute IC50 5.4 mg/l Marine water | Aquatic plants - Plantae - Exponential growth phase | 72 hours |
| | Acute LC50 0.072 mg/l Marine water | Crustaceans - Amphipoda - Adult | 48 hours |
| | Acute LC50 7.56 mg/l Marine water | Fish - Periophthalmus waltoni - Adult | 96 hours |
| | Chronic NOEC 2.5 mg/l Marine water | Algae - Nitzschia closenum - Exponential growth phase | 72 hours |
| | Chronic NOEC 7 mg/l Fresh water | Aquatic plants - Ceratophyllum demersum | 3 days |
| | Chronic NOEC 0.02 mg/l Fresh water | Crustaceans - Cambarus bartonii - Mature | 21 days |
| | Chronic NOEC 2 mg/l Fresh water | Daphnia - Daphnia magna | 21 days |
| | Chronic NOEC 0.8 mg/l Fresh water | Fish - Oreochromis niloticus - Juvenile (Fledgling, Hatchling, Weanling) | 6 weeks |

Ecotoxicity: Pellets may be eaten by wildlife and should be swept up and placed in closed containers. EC50/72h/algae > 1100 mg/L

Persistence and degradability: Not readily biodegradable.

Bioaccumulation:

| Product/ingredient name | LogP | BCF | Potential |
|-------------------------|----------|-----|-----------|
| Silicon | 57 to 77 | . | high |

Mobility: Is not likely mobile in the environment.

Other adverse effects: This substance is not considered to be persistent, bioaccumulating nor toxic (PBT).

Ozone: Not applicable.

SECTION 13 - DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHODS: Should not be released into the environment. Do not contaminate ponds, waterways or ditches with product or used containers.

CONTAMINATED PACKAGING: Empty remaining contents. Do not re-use empty containers. Empty containers should be transported/delivered using a registered waste carrier to local recyclers for disposal.

SECTION 14 - TRANSPORT INFORMATION

DOT: Not regulated.
MEX: Not regulated.
ICAO: Not regulated.
IATA: Not regulated.
IMDG: Not regulated.
UN NUMBER: N/A.

SECTION 15 - REGULATORY INFORMATION

DOT: This product is not regulated by USDOT as a Hazardous Material (49 CFR 172.101). No UN code assigned. No placard required for transportation.
SARA (TITLE III): Under applicable definitions, this material may meet the criteria for a delayed (chronic) health hazard.
SARA (SECTION 313): Not Listed.
CALIFORNIA PROP. 65: Not Listed.
TSCA: Not Listed.
DSCL (EEC): Listed on the DSCL inventory.
RCRA HAZARDOUS WASTE NUMBER: Not Listed.

Sara 313

| COMPONENT | | SARA 313 – Threshold Values % | |
|---------------------------------|--------------|-------------------------------|-----------|
| 1,3-butadiene 106-99-0 | | 0.1 | |
| | Product name | CAS number | % |
| Form R - Reporting requirements | chromium | 7440-47-3 | ≥10 - ≤25 |
| | Nickel | 7440-02-0 | ≤5 |
| | copper | 7440-50-8 | ≤5 |
| Supplier notification | chromium | 7440-47-3 | ≥10 - ≤25 |
| | Nickel | 7440-02-0 | ≤5 |
| | copper | 7440-50-8 | ≤5 |

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

Electrical equipment must be suitable for use in hazardous atmospheres involving Group E combustible dusts in accordance with 29CFR1910.307. Refer to the National Electrical Code (NFPA 70) for guidance in determining the type and design of equipment and installation which meets this requirement.

SARA 311/312 HAZARD CATEGORIES:

Acute Health Hazard: Silicon <1% Yes
Delayed Chronic Health Hazard: Nickel <5% Yes
Fire Hazard: No
Sudden Release of Pressure Hazard: No
Reactive Hazard: No

U.S STATE REGULATIONS:

Massachusetts: The following components are listed Chromium, Nickel, Nickel Catalyst, Copper.

New York: The following components are listed Chromium, Nickel, Copper.

New Jersey: The following components are listed Chromium, Nickel, Copper.

Pennsylvania: The following components are listed Chromium Compounds, Nickel Catalyst, Copper Fume.

CLEAN AIR ACT, TITLE VI (1990): This product does not contain, nor was it manufactured using ozone depleting chemicals.

CALIFORNIA PROPOSITION 65: This product contains the following Proposition 65 chemicals:

| COMPONENT | CALIFORNIA Prop. 65 |
|---------------|--|
| 1,3-butadiene | Carcinogen Developmental Female Reproductive |
| Nickel | Carcinogen |

Inventory Status:

- TSCA (USA): Listed*
- DSL (Canada): Listed*
- NDSL (Canada): Not Listed
- EINECS (Europe): Listed*
- AICS (Australia): Listed*
- ENCS (Japan): Not Identified**
- IECSC (People's Republic of China): Listed*
- PICCS (Philippines): Listed*
- ECL (Korea): Listed*
- ECN (Taiwan): Listed*

**Listed" indicates that all components of this product comply with the inventory requirements administered by the governing country(s).

** Pure metals are not specifically identified by CAS or ENCS number.

SECTION 16 - OTHER INFORMATION, INCLUDING THE DATE OF PREPARATION OF THE LAST REVISION

LABEL REQUIREMENTS: Not expected to produce significant adverse health effects when the recommended instructions for use are followed.

| | | |
|---------------------------|--|---|
| NFPA HAZARD RATINGS | HEALTH | 0 |
| | FLAMMABILITY | 1 |
| | PHYSICAL HAZARD | 0 |
| | INSTABILITY | - |
| | 4=Severe 3=Serious 2=Moderate 1=Slight 0=Minimal | |

| | | |
|---------------------------|--|---|
| HMIS HAZARD RATINGS | HEALTH | 0 |
| | FLAMMABILITY | 1 |
| | PHYSICAL HAZARD | 0 |
| | PERSONAL PROTECTION | X |
| | 4=Severe 3=Serious 2=Moderate 1=Slight 0=Minimal | |

DISCLAIMER: The information provided in this SDS is based on available data from reliable sources and is correct to the best of The Virtual Foundry, Inc's knowledge. The Virtual Foundry, Inc makes no warranty, express or implied, regarding the accuracy of the data or the results obtained from the use of this product. Nothing herein may be construed as recommending any practice or any product in violation of any law or regulations. The user is solely responsible for determining the suitability of any material or product for a specific purpose and for adopting any appropriate safety precautions. 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.

REVISED DATE:

December 2021