

FFF Nylon Filament

Safety Data Sheet

according to the federal final rule of hazard communication revised on 2012 (HazCom 2012)

Date of issue 10/19/2015

Version: 1.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Other means of identification : NYL-AB-1K

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : MarkForged 3D Printing

1.3. Details of the supplier of the safety data sheet

Company:

MarkForged, Inc

10 Fawcett St, Suite 1

Cambridge, MA 02138

Telephone: 617-666-1935

Website: www.markforged.com

1.4. Emergency telephone number

Emergency number : +1-617-666-1935

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

Other hazards which do not result in classification : This is a polymeric material containing caprolactam. The caprolactam is encapsulated within the polymer system and therefore presents minimal likelihood of exposure under normal handling. Processing molten nylon may result in thermal burns or potential exposure to caprolactam vapor.

2.4. Unknown acute toxicity (GHS-US)

Not applicable

SECTION 3: Composition/information on ingredients

3.1. Substances

Not applicable

3.2. Mixture

Name	Product identifier	%	GHS-US classification
Nylon		~93	Not classified
Caprolactam	(CAS No) 105-60-2	~7	Acute Tox. 4 (Oral), H302 Acute Tox. 4 (Inhalation), H332 Skin Irrit. 2, H315 Eye Irrit. 2A, H319 STOT SE 3, H335

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Unlikely route of exposure – solid monofilament product. If subsequent processing of this product generates excessive dust, then treat the dust as “nuisance dust” and minimize exposure. If exposed to excessive levels of dust, remove to fresh air and get medical attention if cough or other symptoms develop. If exposed to vapors, remove individual to fresh air and get medical attention if cough or other symptoms develop.

First-aid measures after skin contact : If skin irritation occurs, then washed exposed skin with soap and plenty of water.

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First-aid measures after eye contact : Do not rub the eyes or the skin around the eye after direct contact with the product. If eye irritation results, then remove contact lenses and immediately flush eye(s) with plenty of water. Keep eye wide open while rinsing. Obtain medical attention if pain, blinking or redness persists.

First-aid measures after ingestion : Unlikely route of exposure. If swallowed, obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : Dusts are mechanical irritants. Dust of the product, if present, may cause respiratory irritation after an excessive inhalation exposure.

Symptoms/injuries after skin contact : Some individuals may experience skin irritation.

Symptoms/injuries after eye contact : Product may cause mechanical irritation to the eye.

Symptoms/injuries after ingestion : Choking hazard or intestinal brockage can occur; gastrointestinal disturbance.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Use fire-extinguishing media appropriate for surrounding materials. Foam. Dry powder. Carbon dioxide. Water spray. Sand.

Unsuitable extinguishing media : Do not use a solid water stream as it may scatter and spread fire.

5.2. Special hazards arising from the substance or mixture

Explosion hazard : No risk anticipated.

5.3. Advice for firefighters

Firefighting instructions : Exercise caution when fighting any chemical fire.

Protective equipment for firefighters : Do not enter fire area without proper protective equipment, including respiratory protection. In the event of a fire, wear a self-contained breathing apparatus (SCBA).

Other information : Toxic and irritating gases are released following thermal decomposition or combustion. Molten material can form flaming droplets if ignited.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Sweep up waste filament and place in trash for disposal as nonhazardous solid waste. Keep away from sources of ignition. Spilled material may present a slipping hazard. Exposure to fire will release irritating toxic fumes and vapors.

6.1.1. For non-emergency personnel

Emergency procedures : Evacuation is not anticipated as necessary in the event of a spill.

6.1.2. For emergency responders

Protective equipment : Use proper shoes to avoid slipping.

Emergency procedures : None anticipated

6.2. Environmental precautions

Prevent entry to sewers and public waters.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : On land, sweep or shovel into suitable containers for disposal. Ensure all national/local regulations are observed.

6.4. Reference to other sections

No additional information available

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SECTION 7: Handling and storage

7.1. Precautions for safe handling

- Additional hazards when processed : The greatest potential for injury may occur when processing molten nylon, which may result in thermal burns or potential exposure to irritating toxic fumes and vapors.
- Precautions for safe handling : Keep away from open flames and sources of ignition.
- Hygiene measures : Handle in accordance with good industrial hygiene and safety practices.

7.2. Conditions for safe storage, including any incompatibilities

- Technical measures : No incompatible materials are anticipated. Product is primarily polyamide.
- Storage conditions : Keep in clean containers to minimize pickup of dust and dirt.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Product dust	ACGIH TWA (mg/m ³)	10 mg/m ³ (Total dust)
Product dust	OSHA TWA (mg/m ³)	15 mg/m ³ (Total dust)
Respirable dust	OSHA TWA (mg/m ³)	5 mg/m ³ (8 Hr)

.epsilon.-Caprolactam (105-60-2)

ACGIH	ACGIH TWA (mg/m ³)	5 mg/m ³ (inhalable fraction and vapor)
NIOSH	NIOSH REL (TWA) (mg/m ³)	1 mg/m ³ (dust) 1 mg/m ³ (vapor)
NIOSH	NIOSH REL (TWA) (ppm)	0.22 ppm (vapor)
NIOSH	NIOSH REL (STEL) (mg/m ³)	3 mg/m ³ (dust) 3 mg/m ³ (vapor)
NIOSH	NIOSH REL (STEL) (ppm)	0.66 ppm (vapor)

8.2. Exposure controls

- Appropriate engineering controls : Operators performing grinding and machining of product should be reviewed to ensure particulate levels are kept below recommended standards. Provide adequate ventilation to minimize dust concentrations. Provide adequate protection in areas where molten material is possible to emerge. Provide local exhaust or general room ventilation to minimize vapour concentrations.
- Personal protective equipment : Avoid all unnecessary exposure. Protective goggles and gloves are recommended around molten polymer. For certain operations, additional Personal Protection Equipment (PPE) may be required.



- Hand protection : Wear protective gloves when handling material at elevated temperatures.
- Eye protection : Safety glasses with side shields. Wear goggles and face shield when handling material at elevated temperatures.
- Skin and body protection : Personal protective clothing should be selected based on the task being performed and the risks involved.
- Respiratory protection : Appropriate dust or mist respirator should be used if airborne particles are generated when handling this material. If elevated airborne concentrations above applicable workplace exposure levels are anticipated, a NIOSH-approved organic vapor respirator equipped with a dust/mist prefilter should be used.
- Thermal hazard protection : Wear protective clothing when handling material at elevated temperatures. Use suitable eye/skin protection.
- Other information : Do not eat, drink or smoke during use.

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SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Solid filament
Appearance	: Cylindrical
Color	: Clear to white
Odor	: Slight organic odor
Odor threshold	: No data available
pH	: Not applicable
Relative evaporation rate (butyl acetate=1)	: No data available
Melting point	: 215 - 218 °C (419 – 425 °F)
Freezing point	: No data available
Boiling point	: Not applicable
Flash point	: No data available
Auto-ignition temperature	: No data available
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: Negligible.
Relative vapour density at 20 °C	: Not relevant
Relative density	: No data available
Density	: Approximately 1.08 Specific Gravity
Solubility	: Negligible in water
Log Pow	: No data available
Log Kow	: No data available
Viscosity, kinematic	: No data available
Viscosity, dynamic	: No data available
Explosive properties	: No data available
Oxidizing properties	: No data available
Explosive limits	: No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

No additional information available.

10.2. Chemical stability

The product is stable at normal handling and storage conditions.

10.3. Possibility of hazardous reactions

Hazardous polymerization will not occur.

10.4. Conditions to avoid

Heat/sparks, open flames, excessively hot surfaces.

10.5. Incompatible materials

No additional information available.

10.6. Hazardous decomposition products

Thermal combustion may release carbon monoxide and dioxide, fumes, unburned hydrocarbons, ammonia, amines, ketone, hydrogen cyanide, amides, and nitriles. Toxic and irritating gases are released following thermal decomposition or combustion. May release flammable gases.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

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Acute toxicity	: Not classified (Based on available data, the classification criteria are not met)
Skin corrosion/irritation	: Not classified (Based on available data, the classification criteria are not met) pH: Not applicable
Serious eye damage/irritation	: Not classified (Based on available data, the classification criteria are not met) pH: Not applicable
Respiratory or skin sensitisation	: Not classified (Based on available data, the classification criteria are not met)
Germ cell mutagenicity	: Not classified (Based on available data, the classification criteria are not met)
Carcinogenicity	: Not classified (Based on available data, the classification criteria are not met)
Reproductive toxicity	: Not classified (Based on available data, the classification criteria are not met)
Specific target organ toxicity (single exposure)	: Not classified (Based on available data, the classification criteria are not met)
Specific target organ toxicity (repeated exposure)	: Not classified (Based on available data, the classification criteria are not met)
Aspiration hazard	: Not classified (Based on available data, the classification criteria are not met)
Symptoms/injuries after inhalation	: Dusts are mechanical irritants. Dust of the product, if present, may cause respiratory irritation after an excessive inhalation exposure.
Symptoms/injuries after skin contact	: Dust may cause mechanical irritation. Risk of thermal burns on contact with molten product.
Symptoms/injuries after eye contact	: Product fines may cause mechanical irritation. Vapors from molten nylon may cause irritation and tearing.
Symptoms/injuries after ingestion	: Choking hazard. Gastrointestinal disturbance can occur.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general	: Material insoluble in water. Material in fiber form may mechanically cause adverse effects if ingested by waterfowl or aquatic life. No ecotoxicological information is available for this product. These products are not considered degradable or toxic in terms of their physical impact. Material is expected to have low aquatic toxicity because of its insolubility in water.
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12.2. Persistence and degradability

Monofilaments for 3D Printing

Persistence and degradability	Not established.
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12.3. Bioaccumulative potential

Monofilaments for 3D Printing

Bioaccumulative potential	Not established.
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12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Effect on ozone layer	: No additional information available
Effect on the global warming	: No additional information available
Other information	: Avoid release to the environment.

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SECTION 13: Disposal considerations

13.1. Waste treatment methods

- Waste disposal recommendations : Recycle product or dispose safely. Can be incinerated according to local regulations. Incineration with energy recovery and landfill. Dispose in a safe manner in accordance with local/national regulations. Dispose of contents/container to comply with applicable local, national and international regulations.
- Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

- In accordance with DOT
Not regulated for transport

Additional information

- Other information : No supplementary information available.

ADR

No additional information available

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

All components of this product are listed on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory

This product or mixture does not contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

15.2. International regulations

CANADA

Monofilaments for 3D Printing

WHMIS Classification	Not classified
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EU-Regulations

This product does not contain as intentionally added additives or ingredients any Substances of Very High Concern (SVHC) banned by Directive 1907/2006 as of the list dated June 15, 2015.

Even though this nylon polymer is not considered electrical or electronic equipment (EEE) as defined by Directive 2011/65/EU, the same product do not contain as intentionally added additives or ingredients any of the restricted substances listed ANNEX II of Directive 2011/65/EU.

Lead, mercury, cadmium, and hexavalent chromium have not been intentionally added to the polymer and thus it is suitable for use in vehicles that need to be compliant with EU Directive 2000/53/EC (End of Life – Vehicles).

Azo dyes and other substances banned by EU Directive 2002/61/EC have not been intentionally added to this product.

The substances regulated by European Directive 1895/2005/EC have not ben intentionally added to this product.

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Regarding carcinogenic, mutagenic, and reproduction toxic substances (CMRs), the product portfolio listed on page 1 does not contain any banned or restricted substances in Categories 1, 2 and 3.

Classification according to Directive 67/548/EEC or 1999/45/EC

No additional information available

15.2.2. National regulations

This product in compliance with the U.S. Toxic Substance Control Act.

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The minerals regulated by the Dodd-Frank Wall Street Reform and Consumer Protection Act are not intentionally added to this product. These regulated minerals are not necessary to the functionality of or the manufacturing of this polymer.

15.3. US State regulations

This product does not contain any chemicals known in the state of California to cause cancer, as of the Proposition 65 List dated June 6, 2014.

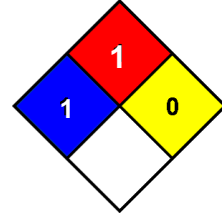
SECTION 16: Other information

Other information : None.

NFPA health hazard : 1 - Exposure could cause irritation but only minor residual injury even if no treatment is given.

NFPA fire hazard : 1 - Must be preheated before ignition can occur.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 1 Slight Hazard - Irritation or minor reversible injury possible

Flammability : 1 Slight Hazard

Physical : 0 Minimal Hazard

SDS US (GHS HazCom 2012)

This product is NOT intended for use in medical implants.

The information contained herein is presented in good faith and is accurate to the best of our knowledge. MarkForged can not guarantee that any hazards listed herein are the only ones which may exist. MarkForged makes no warranty of any kind, expressed or implied, concerning the safe use of this material in your process or in combination with other substances. User has the sole responsibility to determine the suitability of the material for their use. User must meet all applicable safety and health standards.