

SAFETY DATA SHEET

According to OSHA Hazcom Standard 29 CFR 1910.1200

TFDH

Date of issue: 2022-03-28

Revision date: Not applicable

Version: 1.0

1. IDENTIFICATION

A. Product name

- TFDH

B. Recommended use and restriction on use

- General use : UV-curable 3D printing material
 - Restriction on use : Not available

C. Manufacturer / Supplier / Distributor information

o Manufacturer information

- Company name : Graphy Inc.
 - Address : #603, #607, Ace Gasan Forhu, 225, Gasan digital 1-ro, Geumcheon-gu, Seoul, Republic of Korea
 - Emergency telephone number : 82-2-864-3056

o Supplier/Distributor information

- Company name : Graphy Inc.
 - Address : #603, #607, Ace Gasan Forhu, 225, Gasan digital 1-ro, Geumcheon-gu, Seoul, Republic of Korea
 - Emergency telephone number : 82-2-864-3056

2. HAZARD IDENTIFICATION

A. GHS Classification

- Acute toxicity (oral) : Category5
 - Acute toxicity (dermal) : Category5
 - Acute toxicity (inhalation: vapor) : Category4
 - Skin corrosion/irritation : Category2
 - Skin sensitization : Category1
 - Acute aquatic toxicity : Category2

B. GHS label elements

o Hazard symbols



o Signal words

- Warning

o Hazard statements

- H303 May harmful if swallowed.
 - H313 May be harmful if contact with skin.
 - H315 Causes skin irritation
 - H317 May cause an allergic skin reaction
 - H332 Harmful if inhaled
 - H401 Toxic to aquatic organisms.

o Precautionary statements

1) Prevention

- P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
 - P264 Wash hands thoroughly after handling.
 - P271 Use only outdoors or in a well-ventilated area.

- P272 Contaminated work clothing should not be allowed out of the workplace.
- P273 Avoid release to the environment.
- P280 Wear protective gloves/protective clothing/eye protection/face protection/hearing protection.

2) Response

- P301+P312 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
- P302+P312 IF ON SKIN: Call a POISON CENTER/doctor if you feel unwell.
- P302+P352 IF ON SKIN: Wash with plenty of soap and water.
- P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
- P312 Call a POISON CENTER or doctor/physician if you feel unwell.
- P321 Specific treatment
- P332+P313 If skin irritation occurs: Get medical advice/attention.
- P333+P313 If skin irritation or rash occurs: Get medical advice/attention.
- P362+P364 Take off contaminated clothing and wash before reuse.

3) Storage

- Not applicable

4) Disposal

- P501 Dispose of contents/container in accordance with local/regional/national/international regulation

C. Other hazards which do not result in classification

- Not available

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Trade names and Synonyms	CAS No.	Content(%)
Proprietary Ingredient #1	Not available	-	40 ~ 60
Proprietary Ingredient #2	Not available	-	10 ~ 30
Proprietary Ingredient #3	Not available	-	10 ~ 30
Proprietary Ingredient #4	Not available	-	1 ~ 20
Photoinitiator	Not available	-	0 ~ 10
Titanium dioxide	Titanium oxide (TiO ₂) ; Titanium peroxide (TiO ₂) ; Dioxotitanium ; Pigment white 6	13463-67-7	0 ~ 1
Pigment #1	Not available	-	0 ~ 1
Zirconium dioxide	Zirconium oxide (ZrO ₂) ; Zirconium(IV) oxide ; Zirconic anhydride ; Zirconium White ;	1314-23-4	0 ~ 1
Pigment #2	Not available	-	0 ~ 1
Pigment #3	Not available	-	0 ~ 1

4. FIRST AID MEASURES

A. Eye contact

- Do not rub your eyes.
- Immediately flush eyes with plenty of water for at least 15 minutes and call a doctor/physician.

B. Skin contact

- Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
- Wash contaminated clothing thoroughly before re-using.
- Go to the hospital immediately if symptoms (flare, irritate) occur.
- Wash thoroughly after handling.

C. Inhalation contact

- Take specific treatment if needed.
- When exposed to large amounts of steam and mist, move to fresh air.
- If breathing is stopped or irregular, give artificial respiration and supply oxygen.

D. Ingestion contact

- Please be advised by doctor whether induction of vomit is demanded or not.
- Rinse your mouth with water immediately.

E. Delayed and immediate effects and also chronic effects from short and long term exposure

- Not available

F. Notes to physician

- Notify medical personnel of contaminated situations and have them take appropriate protective measures.

5. FIREFIGHTING MEASURES

A. Suitable (Unsuitable) extinguishing media

- Avoid use of water jet for extinguishing
- Dry chemical, carbon dioxide, regular foam extinguishing agent, spray

B. Specific hazards arising from the chemical

- Causes skin irritation
- Harmful if inhaled
- May be harmful if contact with skin.
- May cause an allergic skin reaction
- May harmful if swallowed.

C. Special protective actions for firefighters

- Avoid inhalation of materials or combustion by-products.
- Cool containers with water until well after fire is out.
- Do not approach the tank surrounded by fire until it is extinguished.
- In case of conflagration, use automatic fire sprinkler. Major fire may require withdrawal, allowing the object itself to burn.
- Keep unauthorized personnel out.

6. ACCIDENTAL RELEASE MEASURES

A. Personal precautions, protective equipment and emergency procedures

- Do not touch spilled material. Stop leak if you can do it without risk.
- Handle the damaged containers or spilled material after wearing appropriate protective equipment
- Move container to safe area from the leak area.
- Must work against the wind, let the upwind people to evacuate.
- Remove all sources of ignition.

B. Environmental precautions

- If large amounts have been spilled, inform the relevant authorities.
- Prevent runoff and contact with waterways, drains or sewers.

C. Methods and materials for containment and cleaning up

- Appropriate container for disposal of spilled material collected.
- Dike for later disposal.
- Disposal of waste shall be in compliance with the Wastes Control Act
- Large spill : Stay upwind and keep out of low areas. Dike for later disposal.
- Notify the central and local government if the emission reach the standard threshold.

7. HANDLING AND STORAGE

A. Precautions for safe handling

- Avoid contact with incompatible materials.
- Avoid direct physical contact.
- Comply with all applicable laws and regulations for handling
- Dealing only with a well-ventilated place.
- Do not handle until all safety precautions have been read and understood.

B. Conditions for safe storage, including any incompatibilities

- Avoid direct sunlight.
- Check regularly for leaks.
- Do not apply any physical shock to container.
- Do not apply direct heat.
- Do not use damaged containers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

A. Exposure limits

- **ACGIH TLV**
 - [Titanium dioxide] : TWA 10 mg/m³
 - [Zirconium dioxide] : TWA 5 mg/m³, as Zr STEL 10 mg/m³, as Zr
- **OSHA PEL**
 - [Titanium dioxide] : 15 mg/m³ (Total dust)
 - [Zirconium dioxide] : 15 mg/m³ (Total dust), 5 mg/m³ (Respirable fraction)

B. Engineering controls

- Business owner is recommended to maintain below recommended exposure limits for the working place with general exhaust of gas/vapour/mist/fume.

C. Individual protection measures, such as personal protective equipment

- **Respiratory protection**
 - Any air-purifying respirator with a full facepiece and an organic vapor canister.
 - Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
 - Any chemical cartridge respirator with organic vapor cartridge(s).
 - Consider warning properties before use.
 - For Unknown Concentration or Immediately Dangerous to Life or Health : Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply. Any self-contained breathing apparatus with a full facepiece.
 - Respiratory protection is ranked in order from minimum to maximum.
 - Under conditions of frequent use or heavy exposure, Respiratory protection may be needed.
- **Eye protection**
 - Provide an emergency eye wash station and quick drench shower in the immediate work area.
 - Wear primary eye protection such as splash resistant safety goggles with a secondary protection face shield.
- **Hand protection**
 - Wear appropriate chemical resistant glove.
- **Skin protection**
 - Wear appropriate chemical resistant protective clothing.
- **Others**
 - Not available

9. PHYSICAL AND CHEMICAL PROPERTIES

A. Appearance	
- Appearance	Viscous liquid
- Color	Magenta
B. Odor	Not available
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	Not available
F. Initial Boiling Point/Boiling Ranges	Not available
G. Flash point	Not available
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Not available
J. Upper/Lower Flammability or explosive limits	Not available
K. Vapour pressure	Not available
L. Solubility	Not available
M. Vapour density	Not available
N. Specific gravity(Relative density)	Not available
O. Partition coefficient of n-octanol/water	Not available
P. Autoignition temperature	Not available
Q. Decomposition temperature	Not available
R. Viscosity	300 ~ 800 cps (25 °C)
S. Molecular weight	Not available

10. STABILITY AND REACTIVITY

A. Chemical Stability

- This material is stable under recommended storage and handling conditions.

B. Possibility of hazardous reactions

- Hazardous Polymerization will not occur.

C. Conditions to avoid

- Avoid : Accumulation of electrostatic charges, Heating, Flames and hot surfaces
- Avoid contact with incompatible materials and condition.

D. Incompatible materials

- Not available

E. Hazardous decomposition products

- May emit flammable vapour if involved in fire.

11. TOXICOLOGICAL INFORMATION

A. Information on the likely routes of exposure

- **Respiratory tracts**
 - Not available
- **Oral**
 - May harmful if swallowed.
- **Eye-Skin**
 - Causes skin irritation
 - May cause an allergic skin reaction

B. Delayed and immediate effects and also chronic effects from short and long term exposure

- **Acute toxicity**
 - * **Oral**
 - Product (ATEmix) : 2000mg/kg < ATEmix <= 5000mg/kg
 - [Proprietary Ingredient #2] : LD50 >2000 mg/kg Rat (OECD Guideline 423, GLP, ECHA)
 - [Proprietary Ingredient #3] : LD50 = 4890 mg/kg Rat (Thomson)
 - [Proprietary Ingredient #4] : LD50 >5000 mg/kg Rat (OECD Guideline 401, GLP, ECHA)
 - [Photoinitiator] : LD50 >2000 mg/kg Rat (GLP, ECHA)
 - [Titanium dioxide] : LD50 >5000 mg/kg Mouse (OECD TG 420) (OECD SIDS)
 - [Zirconium dioxide] : LD50 >5000 mg/kg Rat (OECD Guideline 423, GLP, ECHA)
 - [Pigment #2] : LD50 > 5000 mg/kg Rat
 - * **Dermal**
 - Product (ATEmix) : 2000mg/kg < ATEmix <= 5000mg/kg
 - [Proprietary Ingredient #2] : LD50 >2000 mg/kg Rat (OECD Guideline 402, GLP, ECHA)
 - [Proprietary Ingredient #3] : LD50 > 5000 mg/kg Rat (Thomson)
 - [Photoinitiator] : LD50 >2000 mg/kg Rat (GLP, ECHA)
 - * **Inhalation**
 - Product (ATEmix) : 10.0mg/L < ATEmix <= 20.0mg/L
 - [Proprietary Ingredient #3] : Mist LC50 1 ~ 5 mg/l 4 hr Rat (OECD Test Guideline 436, GLP)(OSHRI)
 - [Titanium dioxide] : LC50 >6.82 mg/l Rat (OECD TG 403)(ECHA)
 - [Zirconium dioxide] : LC50 >4.3 mg/l 4 hr Rat (OECD Guideline 436, GLP, ECHA)
- **Skin corrosion/irritation**
 - Causes skin irritation
- **Serious eye damage/irritation**
 - Not available
- **Respiratory sensitization**
 - Not available
- **Skin sensitization**
 - May cause an allergic skin reaction

- **Carcinogenicity**
 - * **IARC**
 - [Titanium dioxide] : Group 2B
 - * **OSHA**
 - Not available
 - * **ACGIH**
 - [Titanium dioxide] : A4
 - [Zirconium dioxide] : A4 (Zirconium compounds)
 - * **NTP**
 - Not available
 - * **EU CLP**
 - Not available
- **Germ cell mutagenicity**
 - Not available
- **Reproductive toxicity**
 - Not available
- **STOT-single exposure**
 - Not available
- **STOT-repeated exposure**
 - Not available
- **Aspiration hazard**
 - Not available

12. ECOLOGICAL INFORMATION

A. Ecotoxicity

- **Fish**
 - [Proprietary Ingredient #2] : LC50 4 mg/ℓ 96 hr Oncorhynchus mykiss (OECD Guideline 203, GLP, ECHA)
 - [Proprietary Ingredient #3] : LC50 = 0.704 mg/ℓ 96 hr (Danio rerio) (ECHA)
 - [Photoinitiator] : Zebra Fish Brachydanio rerio, LC50 > 0.09 mg/L, NOEC > 0.09 mg/L(ECHA)
 - [Titanium dioxide] : LC50 >100 mg/L 96 hr Carassius auratus, Oncorhynchus mykiss (ECHA)
 - [Zirconium dioxide] : LC50 >100 mg/ℓ 96 hr Brachydanio rerio(OECD Guideline 203) (ECHA)
- **Crustaceans**
 - [Proprietary Ingredient #2] : EC50 20 mg/ℓ 48 hr Daphnia magna (OECD Guideline 202, GLP, ECHA)
 - [Proprietary Ingredient #4] : EC50 >1.2 mg/ℓ 48 hr Daphnia magna (OECD Guideline 202, GLP, ECHA)
 - [Photoinitiator] : other aquatic crustacea: Daphnia magna, EC50 > 1.175 mg/L, EC100 > 1.175 mg/L, NOEC 0.003 mg/L(ECHA)
 - [Titanium dioxide] : EC50 >100 mg/L 48 hr Daphnia magna, OECD TG 202 (ECHA)
 - [Zirconium dioxide] : EC50 >100 mg/ℓ 48 hr Daphnia magna(EU Method C.2 Acute Toxicity for Daphnia, GLP) (ECHA)
- **Algae**
 - [Proprietary Ingredient #2] : EC50 34 mg/ℓ 72 hr Other (OECD Guideline 201, GLP, ECHA)
 - [Proprietary Ingredient #3] : EC50 = 0.596 mg/ℓ 72 hr (Pseudokirchneriella subcapitata) (ECHA)
 - [Proprietary Ingredient #4] : EC50 >0.68 mg/ℓ 72 hr Other (ECHA)
 - [Photoinitiator] : Desmodesmus subspicatus (previous name: Scenedesmus subspicatus), EC50 > 0.26 mg/L, NOEC > 0.26 mg/L(ECHA)
 - [Titanium dioxide] : ErL50 > 100 mg/ℓ 72 hr Pseudokirchneriella subcapitata, growth rate, static, (72h-EyL50 >100 mg/L static, OECD TG 201) (ECHA)
 - [Zirconium dioxide] : EC50 >100 mg/ℓ 72 hr (Desmodesmus subspicatus, OECD Guideline 201(Alga, Growth Inhibition Test), GLP, Read-across) (ECHA)

B. Persistence and degradability

- **Persistence**
 - [Proprietary Ingredient #2] : log Kow = 1.9 (ECHA)
 - [Proprietary Ingredient #3] : log Kow = 4.52 (ECHA)
 - [Proprietary Ingredient #4] : log Kow = 3 (Estimate)
 - [Photoinitiator] : log Pow 5.8 (22 °C)(ECHA)
 - [Pigment #1] : log Kow 2.54 (Estimate)
 - [Pigment #2] : log Kow 4.24 (Estimate)
- **Degradability**
 - Not available

C. Bioaccumulative potential

o Bioaccumulative potential

- [Pigment #1] : BCF 9.84 (Estimate)
- [Zirconium dioxide] : BCF 0.64 (ECHA)
- [Pigment #2] : BCF 10 (Estimate)

o Biodegradation

- [Proprietary Ingredient #2] : 28 (%), 28 day (ECHA)
- [Proprietary Ingredient #3] : readily biodegradable(ECHA)
- [Proprietary Ingredient #4] : 22 (%), 28 day (ECHA)
- [Photoinitiator] : 1% degradation after 29 days The substance is not readily biodegradable.(ECHA)
- [Pigment #2] : (Cut-off value =-0.5669 : non-degradable (BIOWIN 5))

D. Mobility in soil

- [Proprietary Ingredient #4] : Koc 1512 (Estimate)
- [Pigment #1] : Koc = 77540
- [Pigment #2] : Koc 36660 (Can be adsorbed in the soil)

E. Other adverse effects

- [Proprietary Ingredient #4] : Algae(Desmodesmus subspicatus): 72h NOEC> 210 µg/L (ECHA)□
- [Zirconium dioxide] : algae, Scenedesmus subspicatus, NOEC 72hr 32mg/L, OECD Guideline 201, Alga, Growth Inhibition Test, GLP(ECHA)

13. DISPOSAL CONSIDERATIONS

A. Disposal methods

- It shall be treated by incineration
- Oil water separation technology shall be applied as pre-waste treatment if it is applicable
- Stabilization and minimization treatment by incineration or similar method can be applied, if more than two kinds of designated wastes are in mixture state and it is impractical to separate them

B. Special precautions for disposal

- Anyone with business license number who generates industrial wastes shall treat the waste by him/herself or by entrusting to the legal entities who treat the wastes, recycle the wastes of others or install and operate the waste treatment facilities according to the Wastes Control Act
- Dispose of waste in accordance with all applicable laws and regulations.

14. TRANSPORT INFORMATION

A. UN No. (IMDG CODE/IATA DGR)

- Not applicable

B. Proper shipping name

- Not applicable

C. Hazard Class

- Not applicable

D. IMDG CODE/IATA DGR Packing group

- Not applicable

E. Marine pollutant

- Not applicable

F. Special precautions for user related to transport or transportation measures

- Air transport(IATA): Not subject to IATA regulations.
- Local transport follows in accordance with Dangerous goods Safety Management Law.
- Package and transport follow in accordance with Department of Transportation (DOT) and other regulatory agency requirements.
- EmS FIRE SCHEDULE : Not available
- EmS SPILLAGE SCHEDULE : Not available

15. REGULATORY INFORMATION**A. National and/or international regulatory information**

- **POPs Management Law**
 - [Proprietary Ingredient #1] : Not applicable
 - [Proprietary Ingredient #2] : Not applicable
 - [Proprietary Ingredient #3] : Not applicable
 - [Proprietary Ingredient #4] : Not applicable
 - [Photoinitiator] : Not applicable
 - [Titanium dioxide] : Not applicable
 - [Pigment #1] : Not applicable
 - [Zirconium dioxide] : Not applicable
 - [Pigment #2] : Not applicable
 - [Pigment #3] : Not applicable
- **Information of EU Classification**
 - * **Classification**
 - [Photoinitiator] : H317,H413
- **U.S. Federal regulations**
 - * **OSHA PROCESS SAFETY (29CFR1910.119)**
 - Not applicable
 - * **CERCLA Section 103 (40CFR302.4)**
 - Not applicable
 - * **EPCRA Section 302 (40CFR355.30)**
 - Not applicable
 - * **EPCRA Section 304 (40CFR355.40)**
 - Not applicable
 - * **EPCRA Section 313 (40CFR372.65)**
 - Not applicable
- **Rotterdam Convention listed ingredients**
 - Not applicable
- **Stockholm Convention listed ingredients**
 - Not applicable
- **Montreal Protocol listed ingredients**
 - Not applicable

16. OTHER INFORMATION**A. Reference**

- The information contained herein is believed to be accurate. It is provided independently of any sale of the product for purpose of hazard communication. It is not intended to constitute performance information concerning the product. No express warranty, or implied warranty of merchantability or fitness for a particular purpose is made with respect to the product or the information contained herein.
- This Safety Data Sheet was compiled with data and information from the following sources: KOSHA, NITE, ESIS, NLM, SIDS, IPCS

B. Issue date

- 2022-03-28

C. Revision number and Last date revised

- Not applicable

D. Other

- This SDS is prepared according to the Globally Harmonized System (GHS).