



SAFETY DATA SHEET

MATERION

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

1.1. Product identifier

| | |
|------------------------------|-------------------------|
| Name of the substance | Thulium Fluoride (TmF3) |
| Identification number | 237-353-7 (EC number) |
| Synonyms | None. |
| Document number | 2CX |
| Materion Code | 2CX |
| Issue date | 15-December-2015 |
| Version number | 02 |
| Revision date | 15-January-2018 |
| Supersedes date | 15-December-2015 |

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

| | |
|-----------------------------|----------------|
| Identified uses | Not available. |
| Uses advised against | None known. |

1.3. Details of the supplier of the safety data sheet

Supplier

| | |
|-----------------------|---|
| Company name | Materion Advanced Chemicals Inc. |
| Address | 407 N. 13th Street 1316 W. St. Paul Avenue Milwaukee, WI 53233 United States |
| Division | Milwaukee |
| Telephone | 414.212.0257 |
| e-mail | advancedmaterials@materion.com |
| Contact person | Noreen Atkinson |

1.4. Emergency telephone number

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

The substance has been assessed and/or tested for its physical, health and environmental hazards and the following classification applies.

Classification according to Regulation (EC) No 1272/2008 as amended

This substance does not meet the criteria for classification according to Regulation (EC) 1272/2008 as amended.

| | |
|-----------------------|--|
| Hazard summary | Not classified for health hazards. However, occupational exposure to the mixture or substance(s) may cause adverse health effects. |
|-----------------------|--|

2.2. Label elements

Label according to Regulation (EC) No. 1272/2008 as amended

| | |
|--------------------------|--|
| Contains: | Thulium Fluoride (TmF3) |
| Hazard pictograms | None. |
| Signal word | None. |
| Hazard statements | The substance does not meet the criteria for classification. |

Precautionary statements

| | |
|-------------------|--|
| Prevention | Observe good industrial hygiene practices. |
| Response | Wash hands after handling. |
| Storage | Store away from incompatible materials. |
| Disposal | Dispose of waste and residues in accordance with local authority requirements. |

| | |
|---------------------------------------|--|
| Supplemental label information | For further information, please contact the Product Stewardship Department at +1.800.862.4118. |
|---------------------------------------|--|

| | |
|---------------------------|-------------|
| 2.3. Other hazards | None known. |
|---------------------------|-------------|

SECTION 3: Composition/information on ingredients

3.1. Substances

General information

| Chemical name | % | CAS-No. / EC No. | REACH Registration No. | INDEX No. | Notes |
|-------------------------|----------|-------------------------|------------------------|-----------|-------|
| Thulium Fluoride (TmF3) | 90 - 100 | 13760-79-7 237-353-7 | - | - | # |
| Classification: | - | | | | |

List of abbreviations and symbols that may be used above

M: M-factor

vPvB: very persistent and very bioaccumulative substance.

PBT: persistent, bioaccumulative and toxic substance.

#: This substance has been assigned Community workplace exposure limit(s).

SECTION 4: First aid measures

General information

Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

4.1. Description of first aid measures

Inhalation

Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact

Wash off with soap and water. Get medical attention if irritation develops and persists.

Eye contact

Rinse with water. Get medical attention if irritation develops and persists.

Ingestion

Rinse mouth. Get medical attention if symptoms occur.

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

Direct contact with eyes may cause temporary irritation.

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

Treat symptomatically.

SECTION 5: Firefighting measures

General fire hazards

No unusual fire or explosion hazards noted.

5.1. Extinguishing media

Suitable extinguishing media

Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).

Unsuitable extinguishing media

Do not use water jet as an extinguisher, as this will spread the fire.

5.2. Special hazards arising from the substance or mixture

During fire, gases hazardous to health may be formed.

5.3. Advice for firefighters

Special protective equipment for firefighters

Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Special firefighting procedures

Use water spray to cool unopened containers.

Specific methods

Use standard firefighting procedures and consider the hazards of other involved materials.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

Keep unnecessary personnel away. For personal protection, see section 8 of the SDS.

For emergency responders

Keep unnecessary personnel away. Use personal protection recommended in Section 8 of the SDS.

6.2. Environmental precautions

Avoid discharge into drains, water courses or onto the ground.

6.3. Methods and material for containment and cleaning up

Stop the flow of material, if this is without risk. Following product recovery, flush area with water.

6.4. Reference to other sections

For personal protection, see section 8 of the SDS. For waste disposal, see section 13 of the SDS.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Avoid prolonged exposure. Observe good industrial hygiene practices.

7.2. Conditions for safe storage, including any incompatibilities

Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

7.3. Specific end use(s)

Not available.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits

Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001

| Material | Type | Value | Form |
|---|------|------------------------|---------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | MAK | 2,5 mg/m ³ | Inhalable fraction. |
| | STEL | 12,5 mg/m ³ | Inhalable fraction. |

Belgium. Exposure Limit Values.

| Material | Type | Value |
|---|------|-----------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m ³ |

Bulgaria. OELs. Regulation No 13 on protection of workers against risks of exposure to chemical agents at work

| Material | Type | Value |
|---|------|-----------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m ³ |

Croatia. Dangerous Substance Exposure Limit Values in the Workplace (ELVs), Annexes 1 and 2, Narodne Novine, 13/09

| Material | Type | Value |
|---|------|-----------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | MAC | 2,5 mg/m ³ |

Czech Republic. OELs. Government Decree 361

| Material | Type | Value |
|---|---------|-----------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | Ceiling | 5 mg/m ³ |
| | TWA | 2,5 mg/m ³ |

Denmark. Exposure Limit Values

| Material | Type | Value |
|---|------|-----------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TLV | 2,5 mg/m ³ |

Estonia. OELs. Occupational Exposure Limits of Hazardous Substances. (Annex of Regulation No. 293 of 18 September 2001)

| Material | Type | Value |
|---|------|-----------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m ³ |

Finland. Workplace Exposure Limits

| Material | Type | Value |
|---|------|-----------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m ³ |

France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984

| Material | Type | Value |
|---|------|-----------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | VME | 2,5 mg/m ³ |

Hungary. OELs. Joint Decree on Chemical Safety of Workplaces

| Material | Type | Value |
|---|------|-----------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | STEL | 10 mg/m ³ |
| | TWA | 2,5 mg/m ³ |

Iceland. OELs. Regulation 154/1999 on occupational exposure limits

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 0,6 mg/m3 |

Latvia. OELs. Occupational exposure limit values of chemical substances in work environment

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m3 |

Lithuania. OELs. Limit Values for Chemical Substances, General Requirements

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m3 |

Luxembourg. Binding Occupational exposure limit values (Annex I), Memorial A

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m3 |

Malta. OELs. Occupational Exposure Limit Values (L.N. 227. of Occupational Health and Safety Authority Act (CAP. 424), Schedules I and V)

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m3 |

Netherlands. OELs (binding)

| Material | Type | Value |
|---|------|---------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | STEL | 2 mg/m3 |

Norway. Administrative Norms for Contaminants in the Workplace

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TLV | 0,5 mg/m3 |

Portugal. OELs. Decree-Law n. 290/2001 (Journal of the Republic - 1 Series A, n.266)

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m3 |

Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796)

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m3 |

Romania. OELs. Protection of workers from exposure to chemical agents at the workplace

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m3 |

Slovakia. OELs. Regulation No. 300/2007 concerning protection of health in work with chemical agents

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m3 |

Spain. Occupational Exposure Limits

| Material | Type | Value |
|---|------|-----------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2,5 mg/m3 |

Sweden. OELs. Work Environment Authority (AV), Occupational Exposure Limit Values (AFS 2015:7)

| Material | Type | Value |
|---|------|---------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | TWA | 2 mg/m3 |

Switzerland. SUVA Grenzwerte am Arbeitsplatz

| Material | Type | Value | Form |
|---|------|---------|-----------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | STEL | 4 mg/m3 | Inhalable dust. |

Switzerland. SUVA Grenzwerte am Arbeitsplatz

| Material | Type | Value | Form |
|----------|------|---------------------|-----------------|
| | TWA | 1 mg/m ³ | Inhalable dust. |

UK. EH40 Workplace Exposure Limits (WELs)

| Material | Type | Value |
|--|------|-----------------------|
| Thulium Fluoride (TmF ₃) (CAS 13760-79-7) | TWA | 2,5 mg/m ³ |

EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU

| Material | Type | Value |
|--|------|-----------------------|
| Thulium Fluoride (TmF ₃) (CAS 13760-79-7) | TWA | 2,5 mg/m ³ |

Biological limit values**Czech Republic. Limit Values for Indicators of Biological Exposure Tests in Urine and Blood, Annex 2, Tables 1 and 2, Government Decree 432/2003 Sb.**

| Material | Value | Determinant | Specimen | Sampling time |
|--|--------------|-------------|---------------------|---------------|
| Thulium Fluoride (TmF ₃) (CAS 13760-79-7) | 60 µmol/mmol | Fluoride | Creatinine in urine | * |
| | 10 mg/g | Fluoride | Creatinine in urine | * |

* - For sampling details, please see the source document.

France. Biological indicators of exposure (IBE) (National Institute for Research and Security (INRS, ND 2065))

| Material | Value | Determinant | Specimen | Sampling time |
|--|---------|-------------|---------------------|---------------|
| Thulium Fluoride (TmF ₃) (CAS 13760-79-7) | 3 mg/g | Fluorures | Creatinine in urine | * |
| | 10 mg/g | Fluorures | Creatinine in urine | * |

* - For sampling details, please see the source document.

Germany. TRGS 903, BAT List (Biological Limit Values)

| Material | Value | Determinant | Specimen | Sampling time |
|--|--------|-------------|---------------------|---------------|
| Thulium Fluoride (TmF ₃) (CAS 13760-79-7) | 7 mg/g | Fluorid | Creatinine in urine | * |
| | 4 mg/g | Fluorid | Creatinine in urine | * |

* - For sampling details, please see the source document.

Hungary. Chemical Safety at Workplace Ordinance Joint Decree No. 25/2000 (Annex 2): Permissible limit values of biological exposure (effect) indices

| Material | Value | Determinant | Specimen | Sampling time |
|--|--------------|-------------|---------------------|---------------|
| Thulium Fluoride (TmF ₃) (CAS 13760-79-7) | 7 mg/g | fluoride | Creatinine in urine | * |
| | 4 mg/g | fluoride | Creatinine in urine | * |
| | 42 µmol/mmol | fluoride | Creatinine in urine | * |
| | 24 µmol/mmol | fluoride | Creatinine in urine | * |

* - For sampling details, please see the source document.

Slovakia. BLVs (Biological Limit Value). Regulation no. 355/2006 concerning protection of workers exposed to chemical agents, Annex 2

| Material | Value | Determinant | Specimen | Sampling time |
|--|--------|-------------|---------------------|---------------|
| Thulium Fluoride (TmF ₃) (CAS 13760-79-7) | 7 mg/g | Fluorides | Creatinine in urine | * |
| | 4 mg/g | Fluorides | Creatinine in urine | * |

* - For sampling details, please see the source document.

Spain. Biological Limit Values (VLBs), Occupational Exposure Limits for Chemical Agents, Table 4

| Material | Value | Determinant | Specimen | Sampling time |
|--|--------|-------------|----------|---------------|
| Thulium Fluoride (TmF ₃) (CAS 13760-79-7) | 8 mg/l | Fluoruros | Urine | * |

* - For sampling details, please see the source document.

| | |
|---|--|
| Recommended monitoring procedures | Follow standard monitoring procedures. |
| Derived no effect levels (DNELs) | Not available. |
| Predicted no effect concentrations (PNECs) | Not available. |

8.2. Exposure controls

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

General information Personal protection equipment should be chosen according to the CEN standards and in discussion with the supplier of the personal protective equipment.

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

- Hand protection Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.

- Other Wear suitable protective clothing.

Respiratory protection In case of insufficient ventilation, wear suitable respiratory equipment.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

Hygiene measures Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

Environmental exposure controls Environmental manager must be informed of all major releases.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance

Physical state Solid.

Form Solid.

Colour Not available.

Odour Not available.

Odour threshold Not available.

pH Not available.

Melting point/freezing point Not available.

Initial boiling point and boiling range Not available.

Flash point Not available.

Evaporation rate Not available.

Flammability (solid, gas) Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%) Not available.

Flammability limit - upper (%) Not available.

Vapour pressure < 0,0000001 kPa at 25 °C

Vapour density Not available.

Relative density Not available.

Solubility(ies)

Solubility (water) Not available.

Partition coefficient (n-octanol/water) Not available.

Auto-ignition temperature Not available.

Decomposition temperature Not available.

Viscosity Not available.

Explosive properties Not explosive.
Oxidising properties Not oxidising.

9.2. Other information

Molecular formula F3Tm

SECTION 10: Stability and reactivity

10.1. Reactivity The product is stable and non-reactive under normal conditions of use, storage and transport.
10.2. Chemical stability Material is stable under normal conditions.
10.3. Possibility of hazardous reactions No dangerous reaction known under conditions of normal use.
10.4. Conditions to avoid Contact with incompatible materials.
10.5. Incompatible materials Strong oxidising agents.
10.6. Hazardous decomposition products No hazardous decomposition products are known.

SECTION 11: Toxicological information

General information Occupational exposure to the substance or mixture may cause adverse effects.

Information on likely routes of exposure

Inhalation Prolonged inhalation may be harmful.
Skin contact No adverse effects due to skin contact are expected.
Eye contact Direct contact with eyes may cause temporary irritation.
Ingestion May cause discomfort if swallowed. However, ingestion is not likely to be a primary route of occupational exposure.

Symptoms Exposure may cause temporary irritation, redness, or discomfort.

11.1. Information on toxicological effects

Acute toxicity No data available.
Skin corrosion/irritation Due to partial or complete lack of data the classification is not possible.
Serious eye damage/eye irritation Due to partial or complete lack of data the classification is not possible.
Respiratory sensitisation Due to partial or complete lack of data the classification is not possible.
Skin sensitisation Due to partial or complete lack of data the classification is not possible.
Germ cell mutagenicity Due to partial or complete lack of data the classification is not possible.
Carcinogenicity Due to partial or complete lack of data the classification is not possible.

Hungary. 26/2000 EüM Ordinance on protection against and preventing risk relating to exposure to carcinogens at work (as amended)

Not listed.

IARC Monographs. Overall Evaluation of Carcinogenicity

Thulium Fluoride (TmF3) (CAS 13760-79-7) 3 Not classifiable as to carcinogenicity to humans.

Reproductive toxicity Due to partial or complete lack of data the classification is not possible.
Specific target organ toxicity - single exposure Due to partial or complete lack of data the classification is not possible.
Specific target organ toxicity - repeated exposure Due to partial or complete lack of data the classification is not possible.
Aspiration hazard Due to partial or complete lack of data the classification is not possible.
Mixture versus substance information No information available.
Other information Not available.

SECTION 12: Ecological information

12.1. Toxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
12.2. Persistence and degradability No data is available on the degradability of this product.
12.3. Bioaccumulative potential No data available.
Partition coefficient n-octanol/water (log Kow) Not available.
Bioconcentration factor (BCF) Not available.

- 12.4. Mobility in soil** No data available.
- 12.5. Results of PBT and vPvB assessment** Not available.
- 12.6. Other adverse effects** No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

12.7. Additional information

Estonia Dangerous substances in groundwater Data

| | |
|--|--------------------------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | Fluoride (as F-ion, total) 1500 UG/L |
| | Fluoride (as F-ion, total) 4000 UG/L |

Estonia Dangerous substances in soil Data

| | |
|--|--------------------------------|
| Thulium Fluoride (TmF3) (CAS 13760-79-7) | Fluoride (as F-ion) 1200 mg/kg |
| | Fluoride (as F-ion) 2000 mg/kg |
| | Fluoride (as F-ion) 450 mg/kg |

SECTION 13: Disposal considerations

13.1. Waste treatment methods

- Residual waste** Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
- Contaminated packaging** Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.
- EU waste code** The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.
- Disposal methods/information** Collect and reclaim or dispose in sealed containers at licensed waste disposal site.
- Special precautions** Dispose in accordance with all applicable regulations.

SECTION 14: Transport information

ADR

14.1. - 14.6.: Not regulated as dangerous goods.

RID

14.1. - 14.6.: Not regulated as dangerous goods.

ADN

14.1. - 14.6.: Not regulated as dangerous goods.

IATA

14.1. - 14.6.: Not regulated as dangerous goods.

IMDG

14.1. - 14.6.: Not regulated as dangerous goods.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulations

Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex I and II, as amended

Not listed.

Regulation (EC) No. 850/2004 On persistent organic pollutants, Annex I as amended

Not listed.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 1 as amended

Not listed.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 2 as amended

Not listed.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 3 as amended

Not listed.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex V as amended

Not listed.

Regulation (EC) No. 166/2006 Annex II Pollutant Release and Transfer Registry, as amended

Not listed.

Regulation (EC) No. 1907/2006, REACH Article 59(10) Candidate List as currently published by ECHA

Not listed.

Authorisations

Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorization, as amended

Not listed.

Restrictions on use

Regulation (EC) No. 1907/2006, REACH Annex XVII Substances subject to restriction on marketing and use as amended

Not listed.

Directive 2004/37/EC: on the protection of workers from the risks related to exposure to carcinogens and mutagens at work, as amended.

Not listed.

Other EU regulations

Directive 2012/18/EU on major accident hazards involving dangerous substances, as amended

Not listed.

Other regulations

The product is classified and labelled in accordance with EC directives or respective national laws. This Safety Data Sheet complies with the requirements of Regulation (EC) No 1907/2006, as amended.

National regulations

Follow national regulation for work with chemical agents.

15.2. Chemical safety assessment

No Chemical Safety Assessment has been carried out.

SECTION 16: Other information

List of abbreviations

Not available.

Information on evaluation method leading to the classification of mixture

Not applicable.

Disclaimer

Materion Advanced Chemicals Inc. cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. This document has been prepared using data from sources considered to be technically reliable and the information is believed to be correct. Materion makes no warranties, expressed or implied, as to the accuracy of the information contained herein. Materion cannot anticipate all conditions under which this information and its products may be used and the actual conditions of use are beyond its control. The user is responsible to evaluate all available information when using this product for any particular use and to comply with all Federal, State, Provincial and Local laws, statutes and regulations.