

## Safety Data Sheet

### 1. Identification

#### 1.1. Product identifier

**Product Identity** 80/20, 50/50, and 65/35 Vanadium-Titanium Mixes (CAB Catalysts)  
**Alternate Names** Vanadium-Titanium Mixes (CAB Catalysts)

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

**Intended use** See Technical Data Sheet.  
**Application Method** See Technical Data Sheet.

#### 1.3. Details of the supplier of the safety data sheet

**Company Name** U.S. Vanadium, LLC  
 4285 Malvern Road  
 Hot Springs, Arkansas 71901; U.S.A  
 (Production Facility)  
**Telephone:** +1-501-262-1270  
**Fax:** +1-501-262-2793  
**Website:**

#### Emergency

**24 hour Emergency Telephone No.** NATIONAL RESPONSE CENTER: +1-800-424-8802  
 CHEMTREC U.S. and CANADA: +1-800-424-9300  
 CHEMTREC International: +1-202-483-7616 (Collect)

### 2. Hazard(s) identification

#### 2.1. Classification of the substance or mixture

Skin Corr. 1B;H314 Causes severe skin burns and eye damage.  
 Eye Dam. 1;H318 Causes serious eye damage.

#### 2.2. Label elements

Using the Toxicity Data listed in section 11 and 12 the product is labeled as follows.



**Signal Word: Danger**

#### Hazard Statements:

H314 Causes severe skin burns and eye damage.  
 H318 Causes serious eye damage.

#### Precautionary Statements:

##### [Prevention]:

P260 Do not breathe mist / vapors / spray.  
 P264 Wash thoroughly after handling.  
 P280 Wear protective gloves / eye protection / face protection.

##### [Response]:

P301+330+331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.  
 P303+361+353 IF ON SKIN (or hair): Remove / Take off immediately all contaminated clothing. Rinse skin with water / shower.  
 P304+340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.  
 P305+351+338 IF IN EYES: Rinse cautiously with water for several minutes. Remove any contact lenses - continue rinsing.  
 P310 Immediately call a POISON CENTER or doctor / physician.  
 P363 Wash contaminated clothing before reuse.

##### [Storage]:

P405 Store locked up.

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### [Disposal]:

P501 Dispose of contents / container in accordance with local / national regulations.

### 3. Composition/information on ingredients

This product contains the following substances that present a hazard within the meaning of the relevant State and Federal Hazardous Substances regulations.

| Ingredient/Chemical Designations                           | Weight % | GHS Classification                           | Notes |
|------------------------------------------------------------|----------|----------------------------------------------|-------|
| <b>Titanium tetrachloride</b><br>CAS Number: 0007550-45-0  | 20 - 50  | Skin Corr. 1B;H314                           | [1]   |
| <b>Vanadium oxytrichloride</b><br>CAS Number: 0007727-18-6 | 50 - 80  | Skin Corr. 1C;H314<br>Aquatic Chronic 2;H411 | [1]   |

In accordance with paragraph (i) of §1910.1200, the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

[1] Substance classified with a health or environmental hazard.

[2] Substance with a workplace exposure limit.

[3] PBT-substance or vPvB-substance.

\*The full texts of the phrases are shown in Section 16.

### 4. First aid measures

#### 4.1. Description of first aid measures

|                   |                                                                                                                                                                                                                                                                                                                                              |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General</b>    | In all cases of doubt, or when symptoms persist, seek medical attention.<br><b>It is imperative that liquid be removed from skin, eyes, and mouth prior to contact with water. Dab liquid from skin using DRY cotton or paper towel. Failure to do so can result in burns caused by thermal hydrolysis when the product contacts water..</b> |
| <b>Inhalation</b> | Remove to fresh air, keep patient warm and at rest. If breathing is irregular or stopped, give artificial respiration. If unconscious place in the recovery position and obtain immediate medical attention. Give nothing by mouth.                                                                                                          |
| <b>Eyes</b>       | Irrigate copiously with clean water for at least 15 minutes, holding the eyelids apart and seek medical attention.                                                                                                                                                                                                                           |
| <b>Skin</b>       | Remove contaminated clothing. Dab liquid from skin using DRY cotton or paper toweling. Flood area with plenty of the coldest water available. See a physician if exposure symptoms develop.                                                                                                                                                  |
| <b>Ingestion</b>  | If swallowed obtain immediate medical attention. Keep at rest. Do NOT induce vomiting.                                                                                                                                                                                                                                                       |

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

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Overview</b> | <b>Eye Contact:</b> Chemical and possible thermal burns with redness, swelling, corneal burns, and possible blindness.<br><b>Skin Contact:</b> Liquid causes chemical burns with redness, swelling, blisters, and pain. Vapors and fumes may cause chemical burns.<br><b>Inhalation:</b> Fumes cause chemical burns of nasal passages, throat, and respiratory tract, with coughing, chest pain, and breathing difficulty.<br><b>Ingestion:</b> Chemical and possible thermal burns of the mouth, throat, stomach, and intestinal tract, with injury to liver and kidneys. See section 2 for further details. |
| <b>Eyes</b>     | Causes serious eye damage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Skin</b>     | Causes severe skin burns and eye damage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

### 5. Fire-fighting measures

#### 5.1. Extinguishing media

Not flammable. Use media suitable for surrounding fire.

#### 5.2. Special hazards arising from the substance or mixture

Dense fumes of product, vanadium pentoxide, titanium dioxide, and hydrochloric acid. Product reacts exothermically with water to form hydrochloric acid, vanadium pentoxide, and titanium dioxide.

Hazardous decomposition: Violently hygroscopic, forming vanadium pentoxide, titanium dioxide, and hydrochloric acid. May generate chlorine on heating.

Do not breathe mist / vapors / spray.

#### 5.3. Advice for fire-fighters

Impermeable acid-resistant clothing. Positive-pressure, self-contained breathing apparatus.

Cool containers immersed in fire by blanketing with cold water. Product reacts violently with water, releasing dense corrosive fumes.

Avoid water contact with product unless absolutely necessary.

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The pressure in closed-product containers exposed to fire can build to dangerous levels. Direct extinguishing media to such containers to keep them cool. Shipping container vapor space contains a fusible plug which melts between 75 and 175°C (165 and 350°F) and a pressure relief valve which opens at 11.9 bar (175 psi).

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### 6. Accidental release measures

#### 6.1. Personal precautions, protective equipment and emergency procedures

Dense fumes of product, vanadium pentoxide, titanium dioxide, and hydrochloric acid. Product reacts exothermically with water to form hydrochloric acid, vanadium pentoxide, and titanium dioxide.

#### 6.2. Environmental precautions

Do not allow spills to enter drains or waterways.

Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

#### 6.3. Methods and material for containment and cleaning up

Dense fumes of product, vanadium pentoxide, titanium dioxide, and hydrochloric acid. Product reacts exothermically with water to form hydrochloric acid, vanadium pentoxide, and titanium dioxide.

Evacuate the area immediately. Cleanup personnel must wear impermeable acid-resistant clothing, including positive-pressure, self-contained breathing apparatus.

Prevent water and moisture contact. Product fumes in air from reaction with atmospheric moisture. Fumes are a mixture of vanadium pentoxide, titanium dioxide, and hydrochloric acid. Vanadium pentoxide is a U.S. EPA-listed hazardous substance with a reportable quantity of 454 kg (1000 lbs.). Titanium tetrachloride is a U.S. EPA-listed hazardous air pollutant (HAP) with a reportable quantity of 0.6 kg (1 lb.).

Minor spills can be misted with water and neutralized with soda ash. Dike large spills with clay, earth, or soda ash. Pump or absorb with dry clay and shovel up to a dry polyethylene container. Steel or aluminum may react and dissolve.

Product may be neutralized in place using foam and soda ash. Vanadium-pentoxide fume has an OSHA PEL of 0.1 mg/m<sup>3</sup>. Titanium dioxide has an OSHA PEL of 15 mg/m<sup>3</sup>. Shipping-container vapor space is fitted with a fusible plug which melts between 75 and 175°C (165 and 350°F) or a reclosing relief valve which opens at 110% of the container MAWP.

### 7. Handling and storage

#### 7.1. Precautions for safe handling

Do not allow contact with moisture. Use only in a closed system. Do not open the container to the atmosphere. Use only approved materials of construction.

See section 2 for further details. - [Prevention]:

#### 7.2. Conditions for safe storage, including any incompatibilities

Store in a closed steel container under a dry inert gas blanket. Storage area should be well ventilated. Protect containers from temperature cycling which may cause breathing.

Incompatible materials: Water, sodium, polar solvents, most plastics, aluminum.

See section 2 for further details. - [Storage]:

#### 7.3. Specific end use(s)

No data available.

### 8. Exposure controls and personal protection

#### 8.1. Control parameters

##### Exposure

| CAS No.      | Ingredient              | Source   | Value                |
|--------------|-------------------------|----------|----------------------|
| 0007550-45-0 | Titanium tetrachloride  | OSHA     | No Established Limit |
|              |                         | ACGIH    | No Established Limit |
|              |                         | NIOSH    | No Established Limit |
|              |                         | Supplier | No Established Limit |
| 0007727-18-6 | Vanadium oxytrichloride | OSHA     | No Established Limit |
|              |                         | ACGIH    | No Established Limit |
|              |                         | NIOSH    | No Established Limit |
|              |                         | Supplier | No Established Limit |

Not listed in OSHA 29 CFR 1910.1000, Table Z-1 (Air Contaminants)

0.05 mg/m<sup>3</sup> for V<sub>2</sub>O<sub>5</sub> (NIOSH TLV TWA)

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0.05 mg/m<sup>3</sup> for 15-Minute Ceiling for Vanadium (NIOSH) 0.5 mg/m<sup>3</sup> for TiCl<sub>4</sub> (8 hour TWA, Titanium Metals Corp.)  
 5 ppm (7 mg/m<sup>3</sup>) Ceiling for Hydrogen Chloride) from Reaction of VOCl<sub>3</sub> with Moisture  
 10 mg/m<sup>3</sup> for TiO<sub>2</sub> (ACGIH TLV TWA) from Reaction of Mixture with Moisture.

### Carcinogen Data

| CAS No.      | Ingredient              | Source | Value                                                              |
|--------------|-------------------------|--------|--------------------------------------------------------------------|
| 0007550-45-0 | Titanium tetrachloride  | OSHA   | Select Carcinogen: No                                              |
|              |                         | NTP    | Known: No; Suspected: No                                           |
|              |                         | IARC   | Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No; |
| 0007727-18-6 | Vanadium oxytrichloride | OSHA   | Select Carcinogen: No                                              |
|              |                         | NTP    | Known: No; Suspected: No                                           |
|              |                         | IARC   | Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No; |

### 8.2. Exposure controls

|                             |                                                                                                                                                                                |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Respiratory</b>          | Use full-face gas mask approved by NIOSH/MSHA; self-contained breathing apparatus.                                                                                             |
| <b>Eyes</b>                 | Use goggles, face mask, face shield; do not wear contact lenses.                                                                                                               |
| <b>Skin</b>                 | Use chemically acid-resistant clothing and boots. Use nitrile or natural-rubber gloves.                                                                                        |
| <b>Engineering Controls</b> | Ensure sufficient ventilation of the workplace. Use recommended materials of construction. Use design and operational practices which exclude atmosphere and moisture contact. |
| <b>Other Work Practices</b> | Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.            |

See section 2 for further details. - [Prevention]:

## 9. Physical and chemical properties

|                                                        |                                                                                                   |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <b>Appearance</b>                                      | Pale Yellow Clear Liquid                                                                          |
| <b>Odor</b>                                            | Acrid                                                                                             |
| <b>Odor threshold</b>                                  | Not determined                                                                                    |
| <b>pH</b>                                              | Not Measured                                                                                      |
| <b>Melting point / freezing point</b>                  | Not Measured                                                                                      |
| <b>Initial boiling point and boiling range</b>         | 128°C (261°F)                                                                                     |
| <b>Flash Point</b>                                     | Not Flammable                                                                                     |
| <b>Evaporation rate (Ether = 1)</b>                    | Not Measured                                                                                      |
| <b>Flammability (solid, gas)</b>                       | Not Applicable                                                                                    |
| <b>Upper/lower flammability or explosive limits</b>    | <b>Lower Explosive Limit:</b> Not Applicable<br><b>Upper Explosive Limit:</b> Not Applicable      |
| <b>Vapor pressure (Pa)</b>                             | 17.5 mm Hg (20°C)                                                                                 |
| <b>Vapor Density</b>                                   | Not Measured                                                                                      |
| <b>Specific Gravity</b>                                | Not Measured                                                                                      |
| <b>Solubility in Water</b>                             | Violently hygroscopic; decomposes to hydrochloric acid, vanadium pentoxide, and titanium dioxide. |
| <b>Partition coefficient n-octanol/water (Log Kow)</b> | Not Measured                                                                                      |
| <b>Auto-ignition temperature</b>                       | Not Measured                                                                                      |
| <b>Decomposition temperature</b>                       | Not Measured                                                                                      |
| <b>Viscosity (cSt)</b>                                 | Not Measured                                                                                      |
| <b>Bulk Density</b>                                    | 1.8                                                                                               |
| <b>Oxidizing Properties</b>                            | Acts as a catalyst in certain chemical environments.                                              |

### 9.2. Other information

No other relevant information.

## 10. Stability and reactivity

### 10.1. Reactivity

Hazardous Polymerization will not occur.

### 10.2. Chemical stability

Stable under normal circumstances.

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### 10.3. Possibility of hazardous reactions

No data available.

### 10.4. Conditions to avoid

Contact with water in any form.

### 10.5. Incompatible materials

Water, sodium, polar solvents, most plastics, aluminum.

### 10.6. Hazardous decomposition products

Violently hygroscopic, forming vanadium pentoxide, titanium dioxide, and hydrochloric acid. May liberate chlorine on heating.

## 11. Toxicological information

### Acute toxicity

| Ingredient                            | Oral LD50, mg/kg | Skin LD50, mg/kg    | Inhalation LC50, mg/L/4hr | Inhalation Dust/Mist LC50, mg/L/4hr | Inhalation Gas LC50, ppm |
|---------------------------------------|------------------|---------------------|---------------------------|-------------------------------------|--------------------------|
| Titanium tetrachloride - (7550-45-0)  | 460 mg/kg (rat)  | 3160 mg/kg (rabbit) | .46 mg/l (rat)            | No data available                   | No data available        |
| Vanadium oxytrichloride - (7727-18-6) | 140 mg/kg (rat)  | No data available   | No data available         | No data available                   | No data available        |

Note: When no route specific LD50 data is available for an acute toxin, the converted acute toxicity point estimate was used in the calculation of the product's ATE (Acute Toxicity Estimate).

| Classification                | Category | Hazard Description                       |
|-------------------------------|----------|------------------------------------------|
| Acute toxicity (oral)         | ---      | Not Applicable                           |
| Acute toxicity (dermal)       | ---      | Not Applicable                           |
| Acute toxicity (inhalation)   | ---      | Not Applicable                           |
| Skin corrosion/irritation     | 1B       | Causes severe skin burns and eye damage. |
| Serious eye damage/irritation | 1        | Causes serious eye damage.               |
| Respiratory sensitization     | ---      | Not Applicable                           |
| Skin sensitization            | ---      | Not Applicable                           |
| Germ cell mutagenicity        | ---      | Not Applicable                           |
| Carcinogenicity               | ---      | Not Applicable                           |
| Reproductive toxicity         | ---      | Not Applicable                           |
| STOT-single exposure          | ---      | Not Applicable                           |
| STOT-repeated exposure        | ---      | Not Applicable                           |
| Aspiration hazard             | ---      | Not Applicable                           |

## 12. Ecological information

### 12.1. Toxicity

No additional information provided for this product. See Section 3 for chemical specific data.

Violently reacts with water forming vanadium pentoxide, titanium dioxide, and hydrochloric acid, any of which may be harmful to an aquatic environment.

### Aquatic Ecotoxicity

| Ingredient                            | 96 hr LC50 fish, mg/l | 48 hr EC50 crustacea, mg/l | ErC50 algae, mg/l |
|---------------------------------------|-----------------------|----------------------------|-------------------|
| Titanium tetrachloride - (7550-45-0)  | Not Available         | Not Available              | Not Available     |
| Vanadium oxytrichloride - (7727-18-6) | Not Available         | Not Available              | Not Available     |

### 12.2. Persistence and degradability

There is no data available on the preparation itself.

### 12.3. Bioaccumulative potential

Not Measured

### 12.4. Mobility in soil

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No data available.

### 12.5. Results of PBT and vPvB assessment

This product contains no PBT/vPvB chemicals.

### 12.6. Other adverse effects

No data available.

## 13. Disposal considerations

### 13.1. Waste treatment methods

Neutralize by slowly reacting with an alkaline solution, preferably lime or sodium hydroxide. Dispose of resulting solution in accordance with local regulatory guidelines

Rinse with alkaline solution, preferably sodium hydroxide. Dispose of rinsed and cleaned packaging in accordance with local regulatory guidelines.

## 14. Transport information

|                                           | DOT (Domestic Surface Transportation)                                                                               | IMO / IMDG (Ocean Transportation)                                                                | ICAO/IATA                                                                                                                            |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>14.1. UN number</b>                    | UN3390                                                                                                              | UN3390                                                                                           | UN3390                                                                                                                               |
| <b>14.2. UN proper shipping name</b>      | UN3390, Toxic by inhalation liquid, corrosive, n.o.s., (Vanadium Oxytrichloride, Titanium Tetrachloride), 6.1(8), I | Toxic by inhalation liquid, corrosive, n.o.s., (Vanadium Oxytrichloride, Titanium Tetrachloride) | Toxic by inhalation liquid, corrosive, n.o.s., (Vanadium Oxytrichloride, Titanium Tetrachloride) <b>FORBIDDEN FOR IATA TRANSPORT</b> |
| <b>14.3. Transport hazard class(es)</b>   | DOT Hazard Class: 6.1(8)                                                                                            | IMDG: 6.1(8)<br>Sub Class: Not Applicable                                                        | Air Class: 6.1(8)                                                                                                                    |
| <b>14.4. Packing group</b>                | I                                                                                                                   | I                                                                                                | I                                                                                                                                    |
| <b>14.5. Environmental hazards</b>        |                                                                                                                     |                                                                                                  |                                                                                                                                      |
| <b>IMDG</b>                               | Marine Pollutant: No                                                                                                |                                                                                                  |                                                                                                                                      |
| <b>14.6. Special precautions for user</b> | No further information                                                                                              |                                                                                                  |                                                                                                                                      |

## 15. Regulatory information

**Regulatory Overview** The regulatory data in Section 15 is not intended to be all-inclusive, only selected regulations are represented.

**Toxic Substance Control Act (TSCA)** All components of this material are either listed or exempt from listing on the TSCA Inventory.

**WHMIS Classification** D2B E

**US EPA Tier II Hazards**

**Fire:** No

**Sudden Release of Pressure:** No

**Reactive:** No

**Immediate (Acute):** Yes

**Delayed (Chronic):** No

**EPCRA 311/312 Chemicals and RQs (lbs):**

Titanium chloride ( 1,000.00)

**EPCRA 302 Extremely Hazardous:**

Titanium chloride

**EPCRA 313 Toxic Chemicals:**

Titanium chloride

Vanadium oxytrichloride

**Proposition 65 - Carcinogens (>0.0%):**

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

**Proposition 65 - Developmental Toxins (>0.0%):**

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

**Proposition 65 - Female Repro Toxins (>0.0%):**

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To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

**Proposition 65 - Male Repro Toxins (>0.0%):**

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

**New Jersey RTK Substances (>1%):**

Titanium tetrachloride

Vanadium oxytrichloride

**Pennsylvania RTK Substances (>1%):**

Titanium tetrachloride

### 16. Other information

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to our products. Customers/users of this product must comply with all applicable health and safety laws, regulations, and orders.

The full text of the phrases appearing in section 3 is:

H314 Causes severe skin burns and eye damage.

H411 Toxic to aquatic life with long lasting effects.

**This is the first version in the GHS SDS format. Listings of changes from previous versions in other formats are not applicable.**

U.S. Vanadium, LLC believes that the data on this sheet are correct as of the effective date and that the opinions given reflect those of qualified experts. Since U.S. Vanadium, LLC cannot control the product or its use, it is the user's responsibility to use the product safely. The data on this sheet apply only to products sold by corporate subsidiaries of U.S. Vanadium, LLC and may not apply to products sold by others.

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