

## Hafnium(IV) oxide

### Apollo Scientific

Part Number: **IN1959**

Version No: **1.1**

Safety Data Sheet (Conforms to Annex II of REACH (1907/2006) - Regulation 2020/878)

Chemwatch Hazard Alert Code: **0**

Issue Date: **16/09/2022**

Print Date: **31/07/2023**

S.REACH.GBR.EN

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

### 1.1. Product Identifier

|                                      |                   |
|--------------------------------------|-------------------|
| <b>Product name</b>                  | Hafnium(IV) oxide |
| <b>Chemical Name</b>                 | hafnium oxide     |
| <b>Synonyms</b>                      | Not Available     |
| <b>Chemical formula</b>              | HfO <sub>2</sub>  |
| <b>Other means of identification</b> | Not Available     |
| <b>CAS number</b>                    | 12055-23-1        |
| <b>EC number</b>                     | 235-013-2         |

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

|                                 |  |
|---------------------------------|--|
| <b>Relevant identified uses</b> | Not Available                                    |
| <b>Uses advised against</b>     | No specific uses advised against are identified. |

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

|                                |   |
|--------------------------------|---|
| <b>Registered company name</b> | <b>Apollo Scientific</b>  |
| <b>Address</b>                 | Whitefield Road, Bredbury SK62QR United Kingdom                                     |
| <b>Telephone</b>               | 01614060505   |
| <b>Fax</b>                     | 0161 406 0506   |
| <b>Website</b>                 | <a href="http://www.apolloscientific.co.uk/">http://www.apolloscientific.co.uk/</a> |
| <b>Email</b>                   | sales@apolloscientific.co.uk  |

### 1.4. Emergency telephone number

|  |                      |
|--|----------------------|
| <b>Association / Organisation</b>        | <b>Not Available</b> |
| <b>Emergency telephone numbers</b>       | Not Available        |
| <b>Other emergency telephone numbers</b> | Not Available        |

## SECTION 2 Hazards identification

### 2.1. Classification of the substance or mixture

|   |                |
|---|----------------|
| <b>Classification according to regulation (EC) No 1272/2008 [CLP] and amendments <sup>[1]</sup></b> | Not Applicable |
|---|----------------|

## 2.2. Label elements

|                            |                       |
|----------------------------|-----------------------|
| <b>Hazard pictogram(s)</b> | Not Applicable        |
| <b>Signal word</b>         | <b>Not Applicable</b> |

### Hazard statement(s)

Not Applicable

### Supplementary statement(s)

Not Applicable

### Precautionary statement(s) Prevention

Not Applicable

### Precautionary statement(s) Response

Not Applicable

### Precautionary statement(s) Storage

Not Applicable

### Precautionary statement(s) Disposal

Not Applicable

## 2.3. Other hazards

REACH - Art.57-59: The mixture does not contain Substances of Very High Concern (SVHC) at the SDS print date.

## SECTION 3 Composition / information on ingredients

### 3.1. Substances

| 1. CAS No<br>2. EC No<br>3. Index No<br>4. REACH No | %[weight] | Name              | Classification according to regulation (EC) No 1272/2008 [CLP] and amendments | SCL / M-Factor | Nanoform Particle Characteristics |
|---|-----------|-------------------|---|----------------|-----------------------------------|
| Not Available                                       | 100       | Hafnium(IV) oxide | Not Applicable  | Not Applicable | Not Available                     |

**Legend:** 1. Classified by Chemwatch; 2. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI; 3. Classification drawn from C&L; \* EU IOELVs available; [e] Substance identified as having endocrine disrupting properties

### 3.2. Mixtures

See 'Information on ingredients' in section 3.1

## SECTION 4 First aid measures

### 4.1. Description of first aid measures

|                     |  |
|---------------------|--|
| <b>Eye Contact</b>  | <p>If this product comes in contact with eyes:</p> <ul style="list-style-type: none"> <li>▶ Wash out immediately with water.</li> <li>▶ If irritation continues, seek medical attention.</li> <li>▶ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.</li> </ul> |
| <b>Skin Contact</b> | <p>If skin or hair contact occurs:</p> <ul style="list-style-type: none"> <li>▶ Flush skin and hair with running water (and soap if available).</li> <li>▶ Seek medical attention in event of irritation.</li> </ul>   |
| <b>Inhalation</b>   | <ul style="list-style-type: none"> <li>▶ If fumes, aerosols or combustion products are inhaled remove from contaminated area.</li> <li>▶ Other measures are usually unnecessary.</li> </ul>  |
| <b>Ingestion</b>    | <ul style="list-style-type: none"> <li>▶ Immediately give a glass of water.</li> <li>▶ First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.</li> </ul>  |

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

See Section 11

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

Treat symptomatically.

## SECTION 5 Firefighting measures

### 5.1. Extinguishing media

- There is no restriction on the type of extinguisher which may be used.
- Use extinguishing media suitable for surrounding area.

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

|                      |             |
|----------------------|-------------|
| Fire Incompatibility | None known. |
|----------------------|-------------|

### 5.3. Advice for firefighters

|                       |   |
|-----------------------|---|
| Fire Fighting         | <ul style="list-style-type: none"> <li>▸ Alert Fire Brigade and tell them location and nature of hazard.</li> <li>▸ Wear breathing apparatus plus protective gloves in the event of a fire.</li> <li>▸ Prevent, by any means available, spillage from entering drains or water courses.</li> <li>▸ Use fire fighting procedures suitable for surrounding area.</li> <li>▸ <b>DO NOT</b> approach containers suspected to be hot.</li> <li>▸ Cool fire exposed containers with water spray from a protected location.</li> <li>▸ If safe to do so, remove containers from path of fire.</li> <li>▸ Equipment should be thoroughly decontaminated after use.</li> </ul> |
| Fire/Explosion Hazard | <ul style="list-style-type: none"> <li>▸ Non combustible.</li> <li>▸ Not considered a significant fire risk, however containers may burn.</li> </ul>  |

## SECTION 6 Accidental release measures

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

See section 8

### 6.2. Environmental precautions

See section 12

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

|              |  |
|--------------|--|
| Minor Spills | <ul style="list-style-type: none"> <li>▸ Clean up all spills immediately.</li> <li>▸ Avoid contact with skin and eyes.</li> <li>▸ Wear impervious gloves and safety glasses.</li> <li>▸ Use dry clean up procedures and avoid generating dust.</li> <li>▸ Vacuum up (consider explosion-proof machines designed to be grounded during storage and use).</li> <li>▸ Do NOT use air hoses for cleaning</li> <li>▸ Place spilled material in clean, dry, sealable, labelled container.</li> </ul>   |
| Major Spills | <ul style="list-style-type: none"> <li>▸ Clear area of personnel and move upwind.</li> <li>▸ Alert Fire Brigade and tell them location and nature of hazard.</li> <li>▸ Control personal contact with the substance, by using protective equipment and dust respirator.</li> <li>▸ Prevent spillage from entering drains, sewers or water courses.</li> <li>▸ Avoid generating dust.</li> <li>▸ Sweep, shovel up. Recover product wherever possible.</li> <li>▸ Put residues in labelled plastic bags or other containers for disposal.</li> <li>▸ If contamination of drains or waterways occurs, advise emergency services.</li> </ul> |

### 6.4. Reference to other sections

Personal Protective Equipment advice is contained in Section 8 of the SDS.

## SECTION 7 Handling and storage

### 7.1. Precautions for safe handling

|               |  |
|---------------|--|
| Safe handling | <ul style="list-style-type: none"> <li>▸ Limit all unnecessary personal contact.</li> <li>▸ Wear protective clothing when risk of exposure occurs.</li> <li>▸ Use in a well-ventilated area.</li> <li>▸ Avoid contact with incompatible materials.</li> <li>▸ When handling, <b>DO NOT eat, drink or smoke.</b></li> </ul> |
|---------------|--|

|                                      |   |
|--------------------------------------|---|
|                                      | <ul style="list-style-type: none"> <li>▶ Keep containers securely sealed when not in use.</li> <li>▶ Avoid physical damage to containers.</li> <li>▶ Always wash hands with soap and water after handling.</li> <li>▶ Work clothes should be laundered separately.</li> <li>▶ Use good occupational work practice.</li> <li>▶ Observe manufacturer's storage and handling recommendations contained within this SDS.</li> <li>▶ Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.</li> </ul>  |
| <b>Fire and explosion protection</b> | See section 5   |
| <b>Other information</b>             | <ul style="list-style-type: none"> <li>▶ Store in original containers.</li> <li>▶ Keep containers securely sealed.</li> <li>▶ Store in a cool, dry area protected from environmental extremes.</li> <li>▶ Store away from incompatible materials and foodstuff containers.</li> <li>▶ Protect containers against physical damage and check regularly for leaks.</li> <li>▶ Observe manufacturer's storage and handling recommendations contained within this SDS.</li> </ul> <p>For major quantities:</p> <ul style="list-style-type: none"> <li>▶ Consider storage in banded areas - ensure storage areas are isolated from sources of community water (including stormwater, ground water, lakes and streams).</li> <li>▶ Ensure that accidental discharge to air or water is the subject of a contingency disaster management plan; this may require consultation with local authorities.</li> </ul> |

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

|  |  |
|--|--|
| <b>Suitable container</b>  | <ul style="list-style-type: none"> <li>▶ Lined metal can, lined metal pail/ can.</li> <li>▶ Plastic pail.</li> <li>▶ Polyliner drum.</li> <li>▶ Packing as recommended by manufacturer.</li> <li>▶ Check all containers are clearly labelled and free from leaks.</li> </ul> |
| <b>Storage incompatibility</b>   | Avoid contamination of water, foodstuffs, feed or seed.<br>None known  |
| <b>Hazard categories in accordance with Regulation (EC) No 1272/2008</b>   | Not Available  |
| <b>Qualifying quantity (tonnes) of dangerous substances as referred to in Article 3(10) for the application of</b> | Not Available  |

## 7.3. Specific end use(s)

See section 1.2

## SECTION 8 Exposure controls / personal protection

### 8.1. Control parameters

| Ingredient    | DNELs<br>Exposure Pattern Worker | PNECs<br>Compartment |
|---------------|----------------------------------|----------------------|
| Not Available | Not Available                    | Not Available        |

\* Values for General Population

### Occupational Exposure Limits (OEL)

#### INGREDIENT DATA

| Source        | Ingredient    | Material name | TWA           | STEL          | Peak          | Notes         |
|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Not Available | Not Available | Not Available | Not Available | Not Available | Not Available | Not Available |

Not Applicable


### Emergency Limits

| Ingredient        | TEEL-1        | TEEL-2        | TEEL-3        |
|-------------------|---------------|---------------|---------------|
| Hafnium(IV) oxide | Not Available | Not Available | Not Available |

Continued...

| Ingredient        | Original IDLH | Revised IDLH  |
|-------------------|---------------|---------------|
| Hafnium(IV) oxide | Not Available | Not Available |

## 8.2. Exposure controls

| <p><b>8.2.1. Appropriate engineering controls</b></p>  | <p>Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.</p> <p>The basic types of engineering controls are:</p> <p>Process controls which involve changing the way a job activity or process is done to reduce the risk.</p> <p>Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use. Employers may need to use multiple types of controls to prevent employee overexposure.</p> <ul style="list-style-type: none"> <li>▶ Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.</li> <li>▶ If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered.</li> </ul> <p>Such protection might consist of:</p> <p>(a): particle dust respirators, if necessary, combined with an absorption cartridge;</p> <p>(b): filter respirators with absorption cartridge or canister of the right type;</p> <p>(c): fresh-air hoods or masks.</p> <p>Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.</p> <table border="1" data-bbox="395 891 1487 1064"> <thead> <tr> <th>Type of Contaminant:</th> <th>Air Speed:</th> </tr> </thead> <tbody> <tr> <td>direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)</td> <td>1-2.5 m/s (200-500 f/min.)</td> </tr> <tr> <td>grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).</td> <td>2.5-10 m/s (500-2000 f/min.)</td> </tr> </tbody> </table> <p>Within each range the appropriate value depends on:</p> <table border="1" data-bbox="395 1108 1204 1288"> <thead> <tr> <th>Lower end of the range</th> <th>Upper end of the range</th> </tr> </thead> <tbody> <tr> <td>1: Room air currents minimal or favourable to capture</td> <td>1: Disturbing room air currents</td> </tr> <tr> <td>2: Contaminants of low toxicity or of nuisance value only.</td> <td>2: Contaminants of high toxicity</td> </tr> <tr> <td>3: Intermittent, low production.</td> <td>3: High production, heavy use</td> </tr> <tr> <td>4: Large hood or large air mass in motion</td> <td>4: Small hood-local control only</td> </tr> </tbody> </table> <p>Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 4-10 m/s (800-2000 f/min) for extraction of crusher dusts generated 2 metres distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.</p> | Type of Contaminant: | Air Speed: | direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion) | 1-2.5 m/s (200-500 f/min.) | grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion). | 2.5-10 m/s (500-2000 f/min.) | Lower end of the range | Upper end of the range | 1: Room air currents minimal or favourable to capture | 1: Disturbing room air currents | 2: Contaminants of low toxicity or of nuisance value only. | 2: Contaminants of high toxicity | 3: Intermittent, low production. | 3: High production, heavy use | 4: Large hood or large air mass in motion | 4: Small hood-local control only |
|--|---|----------------------|------------|--|----------------------------|--|------------------------------|------------------------|------------------------|---|---------------------------------|--|----------------------------------|----------------------------------|-------------------------------|---|----------------------------------|
| Type of Contaminant:   | Air Speed:  |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion) | 1-2.5 m/s (200-500 f/min.)  |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).           | 2.5-10 m/s (500-2000 f/min.)  |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| Lower end of the range   | Upper end of the range  |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| 1: Room air currents minimal or favourable to capture  | 1: Disturbing room air currents   |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| 2: Contaminants of low toxicity or of nuisance value only.   | 2: Contaminants of high toxicity  |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| 3: Intermittent, low production.   | 3: High production, heavy use   |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| 4: Large hood or large air mass in motion  | 4: Small hood-local control only  |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| <p><b>8.2.2. Individual protection measures, such as personal protective equipment</b></p>   |    |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| <p><b>Eye and face protection</b></p>  | <ul style="list-style-type: none"> <li>▶ Safety glasses with side shields</li> <li>▶ Chemical goggles. [AS/NZS 1337.1, EN166 or national equivalent]</li> <li>▶ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].</li> </ul>   |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| <p><b>Skin protection</b></p>  | <p>See Hand protection below</p>  |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |
| <p><b>Hands/feet protection</b></p>  | <p>The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.</p> <p>The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.</p> <p>Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.</p> <p>Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:</p>   |                      |            |  |                            |  |                              |                        |                        |   |                                 |  |                                  |                                  |                               |   |                                  |

|                         |  |
|-------------------------|--|
|                         | <ul style="list-style-type: none"> <li>· frequency and duration of contact,</li> <li>· chemical resistance of glove material,</li> <li>· glove thickness and</li> <li>· dexterity</li> </ul> <p>Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).</p> <ul style="list-style-type: none"> <li>· When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.</li> <li>· When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.</li> <li>· Some glove polymer types are less affected by movement and this should be taken into account when considering gloves for long-term use.</li> <li>· Contaminated gloves should be replaced.</li> </ul> <p>As defined in ASTM F-739-96 in any application, gloves are rated as:</p> <ul style="list-style-type: none"> <li>· Excellent when breakthrough time &gt; 480 min</li> <li>· Good when breakthrough time &gt; 20 min</li> <li>· Fair when breakthrough time &lt; 20 min</li> <li>· Poor when glove material degrades</li> </ul> <p>For general applications, gloves with a thickness typically greater than 0.35 mm, are recommended.</p> <p>It should be emphasised that glove thickness is not necessarily a good predictor of glove resistance to a specific chemical, as the permeation efficiency of the glove will be dependent on the exact composition of the glove material. Therefore, glove selection should also be based on consideration of the task requirements and knowledge of breakthrough times.</p> <p>Glove thickness may also vary depending on the glove manufacturer, the glove type and the glove model. Therefore, the manufacturers technical data should always be taken into account to ensure selection of the most appropriate glove for the task.</p> <p>Note: Depending on the activity being conducted, gloves of varying thickness may be required for specific tasks. For example:</p> <ul style="list-style-type: none"> <li>· Thinner gloves (down to 0.1 mm or less) may be required where a high degree of manual dexterity is needed. However, these gloves are only likely to give short duration protection and would normally be just for single use applications, then disposed of.</li> <li>· Thicker gloves (up to 3 mm or more) may be required where there is a mechanical (as well as a chemical) risk i.e. where there is abrasion or puncture potential</li> </ul> <p>Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.</p> <p>Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.</p> <ul style="list-style-type: none"> <li>▸ polychloroprene.</li> <li>▸ nitrile rubber.</li> <li>▸ butyl rubber.</li> <li>▸ fluorocautchouc.</li> <li>▸ polyvinyl chloride.</li> </ul> <p>Gloves should be examined for wear and/ or degradation constantly.</p> |
| <b>Body protection</b>  | See Other protection below   |
| <b>Other protection</b> | <p>No special equipment needed when handling small quantities.</p> <p><b>OTHERWISE:</b></p> <ul style="list-style-type: none"> <li>▸ Overalls.</li> <li>▸ Barrier cream.</li> <li>▸ Eyewash unit.</li> </ul>   |

## Respiratory protection

Type -P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

| Required Minimum Protection Factor | Half-Face Respirator | Full-Face Respirator | Powered Air Respirator |
|------------------------------------|----------------------|----------------------|------------------------|
| up to 10 x ES                      | P1<br>Air-line*      | -<br>-               | PAPR-P1<br>-           |
| up to 50 x ES                      | Air-line**           | P2                   | PAPR-P2                |
| up to 100 x ES                     | -                    | P3                   | -                      |
|                                    |                      | Air-line*            | -                      |
| 100+ x ES                          | -                    | Air-line**           | PAPR-P3                |

\* - Negative pressure demand \*\* - Continuous flow

A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO<sub>2</sub>), G = Agricultural chemicals, K = Ammonia(NH<sub>3</sub>), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory protection. These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory

protection program.

- Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU)
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

### 8.2.3. Environmental exposure controls

See section 12

## SECTION 9 Physical and chemical properties

### 9.1. Information on basic physical and chemical properties

|   |               |  |                |
|---|---------------|--|----------------|
| <b>Appearance</b>                                   | Off-white     |  |                |
| <b>Physical state</b>                               | Divided Solid | <b>Relative density (Water = 1)</b>            | Not Available  |
| <b>Odour</b>  | Not Available | <b>Partition coefficient n-octanol / water</b> | Not Available  |
| <b>Odour threshold</b>                              | Not Available | <b>Auto-ignition temperature (°C)</b>          | Not Available  |
| <b>pH (as supplied)</b>                             | Not Available | <b>Decomposition temperature (°C)</b>          | Not Available  |
| <b>Melting point / freezing point (°C)</b>          | 2812          | <b>Viscosity (cSt)</b>                         | Not Available  |
| <b>Initial boiling point and boiling range (°C)</b> | Not Available | <b>Molecular weight (g/mol)</b>                | Not Available  |
| <b>Flash point (°C)</b>                             | Not Available | <b>Taste</b>                                   | Not Available  |
| <b>Evaporation rate</b>                             | Not Available | <b>Explosive properties</b>                    | Not Available  |
| <b>Flammability</b>                                 | Not Available | <b>Oxidising properties</b>                    | Not Available  |
| <b>Upper Explosive Limit (%)</b>                    | Not Available | <b>Surface Tension (dyn/cm or mN/m)</b>        | Not Applicable |
| <b>Lower Explosive Limit (%)</b>                    | Not Available | <b>Volatile Component (%vol)</b>               | Not Available  |
| <b>Vapour pressure (kPa)</b>                        | Not Available | <b>Gas group</b>                               | Not Available  |
| <b>Solubility in water</b>                          | Not Available | <b>pH as a solution (1%)</b>                   | Not Available  |
| <b>Vapour density (Air = 1)</b>                     | 9.68          | <b>VOC g/L</b>                                 | Not Available  |
| <b>Nanoform Solubility</b>                          | Not Available | <b>Nanoform Particle Characteristics</b>       | Not Available  |
| <b>Particle Size</b>                                | Not Available |  |                |

### 9.2. Other information

Not Available

## SECTION 10 Stability and reactivity

|   |   |
|---|---|
| <b>10.1.Reactivity</b>                          | See section 7.2   |
| <b>10.2. Chemical stability</b>                 | Product is considered stable and hazardous polymerisation will not occur. |
| <b>10.3. Possibility of hazardous reactions</b> | See section 7.2   |
| <b>10.4. Conditions to avoid</b>                | See section 7.2   |
| <b>10.5. Incompatible materials</b>             | See section 7.2   |
| <b>10.6. Hazardous decomposition products</b>   | See section 5.3   |

## SECTION 11 Toxicological information

### 11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008 Information on toxicological effects

**Hafnium(IV) oxide**

|                     |  |
|---------------------|--|
| <b>Inhaled</b>      | The material is not thought to produce adverse health effects or irritation of the respiratory tract (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.<br>Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.<br>If prior damage to the circulatory or nervous systems has occurred or if kidney damage has been sustained, proper screenings should be conducted on individuals who may be exposed to further risk if handling and use of the material result in excessive exposures. |
| <b>Ingestion</b>    | The material has <b>NOT</b> been classified by EC Directives or other classification systems as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence.   |
| <b>Skin Contact</b> | The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting.  |
| <b>Eye</b>          | Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may cause transient discomfort characterised by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result.   |
| <b>Chronic</b>      | Long-term exposure to the product is not thought to produce chronic effects adverse to the health (as classified by EC Directives using animal models); nevertheless exposure by all routes should be minimised as a matter of course.<br>Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis, caused by particles less than 0.5 micron penetrating and remaining in the lung.   |

|                          |   |                   |
|--------------------------|---|-------------------|
| <b>Hafnium(IV) oxide</b> | <b>TOXICITY</b>   | <b>IRRITATION</b> |
|                          | Inhalation(Rat) LC50: >4.3 mg/l4h <sup>[1]</sup>  | Not Available     |
|                          | Oral (Rat) LD50: >5000 mg/kg <sup>[1]</sup>   |                   |
| <b>Legend:</b>           | 1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances |                   |

|  |          |                                 |          |
|--|----------|---------------------------------|----------|
| <b>Acute Toxicity</b>                    | <b>×</b> | <b>Carcinogenicity</b>          | <b>×</b> |
| <b>Skin Irritation/Corrosion</b>         | <b>×</b> | <b>Reproductivity</b>           | <b>×</b> |
| <b>Serious Eye Damage/Irritation</b>     | <b>×</b> | <b>STOT - Single Exposure</b>   | <b>×</b> |
| <b>Respiratory or Skin sensitisation</b> | <b>×</b> | <b>STOT - Repeated Exposure</b> | <b>×</b> |
| <b>Mutagenicity</b>                      | <b>×</b> | <b>Aspiration Hazard</b>        | <b>×</b> |

**Legend:** **×** – Data either not available or does not fill the criteria for classification  
**✓** – Data available to make classification

**11.2 Information on other hazards**

**11.2.1. Endocrine disrupting properties**

No evidence of endocrine disrupting properties were found in the current literature.

**11.2.2. Other information**

See Section 11.1

**SECTION 12 Ecological information**

**12.1. Toxicity**

|                          |  |                           |                |               |               |
|--------------------------|--|---------------------------|----------------|---------------|---------------|
| <b>Hafnium(IV) oxide</b> | <b>Endpoint</b>  | <b>Test Duration (hr)</b> | <b>Species</b> | <b>Value</b>  | <b>Source</b> |
|                          | Not Available  | Not Available             | Not Available  | Not Available | Not Available |
| <b>Legend:</b>           | Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data |                           |                |               |               |

**12.2. Persistence and degradability**

|                   |                                       |                                       |
|-------------------|---------------------------------------|---------------------------------------|
| <b>Ingredient</b> | <b>Persistence: Water/Soil</b>        | <b>Persistence: Air</b>               |
|                   | No Data available for all ingredients | No Data available for all ingredients |



**12.3. Bioaccumulative potential**

| Ingredient | Bioaccumulation                       |
|------------|---------------------------------------|
|            | No Data available for all ingredients |

**12.4. Mobility in soil**

| Ingredient | Mobility                              |
|------------|---------------------------------------|
|            | No Data available for all ingredients |

**12.5. Results of PBT and vPvB assessment**

|                         | P             | B             | T             |
|-------------------------|---------------|---------------|---------------|
| Relevant available data | Not Available | Not Available | Not Available |
| PBT                     | ✗             | ✗             | ✗             |
| vPvB                    | ✗             | ✗             | ✗             |
| PBT Criteria fulfilled? | No            |               |               |
| vPvB                    | No            |               |               |

**12.6. Endocrine disrupting properties**

No evidence of endocrine disrupting properties were found in the current literature.

**12.7. Other adverse effects**

No evidence of ozone depleting properties were found in the current literature.

**SECTION 13 Disposal considerations****13.1. Waste treatment methods**

|                                     |  |
|-------------------------------------|--|
| <b>Product / Packaging disposal</b> | <p>Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.</p> <p>A Hierarchy of Controls seems to be common - the user should investigate:</p> <ul style="list-style-type: none"> <li>▶ Reduction</li> <li>▶ Reuse</li> <li>▶ Recycling</li> <li>▶ Disposal (if all else fails)</li> </ul> <p>This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate. In most instances the supplier of the material should be consulted.</p> <ul style="list-style-type: none"> <li>▶ <b>DO NOT allow wash water from cleaning or process equipment to enter drains.</b></li> <li>▶ It may be necessary to collect all wash water for treatment before disposal.</li> <li>▶ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.</li> <li>▶ Where in doubt contact the responsible authority.</li> <li>▶ Recycle wherever possible or consult manufacturer for recycling options.</li> <li>▶ Consult State Land Waste Management Authority for disposal.</li> <li>▶ Bury residue in an authorised landfill.</li> <li>▶ Recycle containers if possible, or dispose of in an authorised landfill.</li> </ul> |
| <b>Waste treatment options</b>      | Not Available  |
| <b>Sewage disposal options</b>      | Not Available  |

**SECTION 14 Transport information****Labels Required**

|                         |                |
|-------------------------|----------------|
| <b>Marine Pollutant</b> | NO             |
| <b>HAZCHEM</b>          | Not Applicable |

**Land transport (ADR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS**

|                                     |                |
|-------------------------------------|----------------|
| <b>14.1. UN number or ID number</b> | Not Applicable |
|-------------------------------------|----------------|

|                                    |                                |                |
|------------------------------------|--------------------------------|----------------|
| 14.2. UN proper shipping name      | Not Applicable                 |                |
| 14.3. Transport hazard class(es)   | Class                          | Not Applicable |
|                                    | Subsidiary risk                | Not Applicable |
| 14.4. Packing group                | Not Applicable                 |                |
| 14.5. Environmental hazard         | Not Applicable                 |                |
| 14.6. Special precautions for user | Hazard identification (Kemler) | Not Applicable |
|                                    | Classification code            | Not Applicable |
|                                    | Hazard Label                   | Not Applicable |
|                                    | Special provisions             | Not Applicable |
|                                    | Limited quantity               | Not Applicable |
|                                    | Tunnel Restriction Code        | Not Applicable |

#### Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

|                                    |   |                |
|------------------------------------|---|----------------|
| 14.1. UN number                    | Not Applicable  |                |
| 14.2. UN proper shipping name      | Not Applicable  |                |
| 14.3. Transport hazard class(es)   | ICAO/IATA Class   | Not Applicable |
|                                    | ICAO / IATA Subrisk                                       | Not Applicable |
|                                    | ERG Code  | Not Applicable |
| 14.4. Packing group                | Not Applicable  |                |
| 14.5. Environmental hazard         | Not Applicable  |                |
| 14.6. Special precautions for user | Special provisions  | Not Applicable |
|                                    | Cargo Only Packing Instructions                           | Not Applicable |
|                                    | Cargo Only Maximum Qty / Pack                             | Not Applicable |
|                                    | Passenger and Cargo Packing Instructions                  | Not Applicable |
|                                    | Passenger and Cargo Maximum Qty / Pack                    | Not Applicable |
|                                    | Passenger and Cargo Limited Quantity Packing Instructions | Not Applicable |
|                                    | Passenger and Cargo Limited Maximum Qty / Pack            | Not Applicable |

#### Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

|                                    |                    |                |
|------------------------------------|--------------------|----------------|
| 14.1. UN number                    | Not Applicable     |                |
| 14.2. UN proper shipping name      | Not Applicable     |                |
| 14.3. Transport hazard class(es)   | IMDG Class         | Not Applicable |
|                                    | IMDG Subrisk       | Not Applicable |
| 14.4. Packing group                | Not Applicable     |                |
| 14.5. Environmental hazard         | Not Applicable     |                |
| 14.6. Special precautions for user | EMS Number         | Not Applicable |
|                                    | Special provisions | Not Applicable |
|                                    | Limited Quantities | Not Applicable |

#### Inland waterways transport (ADN): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

|                               |                |  |
|-------------------------------|----------------|--|
| 14.1. UN number               | Not Applicable |  |
| 14.2. UN proper shipping name | Not Applicable |  |

|                                    |                     |                |
|------------------------------------|---------------------|----------------|
| 14.3. Transport hazard class(es)   | Not Applicable      | Not Applicable |
| 14.4. Packing group                | Not Applicable      |                |
| 14.5. Environmental hazard         | Not Applicable      |                |
| 14.6. Special precautions for user | Classification code | Not Applicable |
|                                    | Special provisions  | Not Applicable |
|                                    | Limited quantity    | Not Applicable |
|                                    | Equipment required  | Not Applicable |
|                                    | Fire cones number   | Not Applicable |

#### 14.7. Maritime transport in bulk according to IMO instruments

##### 14.7.1. Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

##### 14.7.2. Transport in bulk in accordance with MARPOL Annex V and the IMSBC Code

| Product name | Group |
|--------------|-------|
|--------------|-------|

##### 14.7.3. Transport in bulk in accordance with the IGC Code

| Product name | Ship Type |
|--------------|-----------|
|--------------|-----------|

### SECTION 15 Regulatory information

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

This safety data sheet is in compliance with the following EU legislation and its adaptations - as far as applicable - : Directives 98/24/EC, - 92/85/EEC, - 94/33/EC, - 2008/98/EC, - 2010/75/EU; Commission Regulation (EU) 2020/878; Regulation (EC) No 1272/2008 as updated through ATPs.

#### Information according to 2012/18/EU (Seveso III):

| Seveso Category | Status        |
|-----------------|---------------|
|                 | Not Available |

#### 15.2. Chemical safety assessment

For further information please look at the Chemical Safety Assessment and Exposure Scenarios prepared by your Supply Chain if available.

### ECHA SUMMARY

Not Applicable

#### National Inventory Status

| National Inventory                              | Status        |
|---|---------------|
| Australia - AIIC / Australia Non-Industrial Use | Not Available |
| Canada - DSL                                    | Not Available |
| Canada - NDSL                                   | Not Available |
| China - IECSC                                   | Not Available |
| Europe - EINEC / ELINCS / NLP                   | Not Available |
| Japan - ENCS                                    | Not Available |
| Korea - KECI                                    | Not Available |
| New Zealand - NZIoC                             | Not Available |
| Philippines - PICCS                             | Not Available |
| USA - TSCA                                      | Not Available |
| Taiwan - TCSI                                   | Not Available |
| Mexico - INSQ                                   | Not Available |
| Vietnam - NCI                                   | Not Available |
| Russia - FBEPH                                  | Not Available |

| National Inventory | Status   |
|--------------------|--|
| <b>Legend:</b>     | <p>Yes = All CAS declared ingredients are on the inventory</p> <p>No = One or more of the CAS listed ingredients are not on the inventory. These ingredients may be exempt or will require registration.</p> |

## SECTION 16 Other information

|                      |            |
|----------------------|------------|
| <b>Revision Date</b> | 16/09/2022 |
| <b>Initial Date</b>  | 16/09/2022 |

### Full text Risk and Hazard codes

#### Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

For detailed advice on Personal Protective Equipment, refer to the following EU CEN Standards:

- EN 166 Personal eye-protection
- EN 340 Protective clothing
- EN 374 Protective gloves against chemicals and micro-organisms
- EN 13832 Footwear protecting against chemicals
- EN 133 Respiratory protective devices

#### Definitions and abbreviations

- PC - TWA: Permissible Concentration-Time Weighted Average
- PC - STEL: Permissible Concentration-Short Term Exposure Limit
- IARC: International Agency for Research on Cancer
- ACGIH: American Conference of Governmental Industrial Hygienists
- STEL: Short Term Exposure Limit
- TEEL: Temporary Emergency Exposure Limit,
- IDLH: Immediately Dangerous to Life or Health Concentrations
- ES: Exposure Standard
- OSF: Odour Safety Factor
- NOAEL :No Observed Adverse Effect Level
- LOAEL: Lowest Observed Adverse Effect Level
- TLV: Threshold Limit Value
- LOD: Limit Of Detection
- OTV: Odour Threshold Value
- BCF: BioConcentration Factors
- BEI: Biological Exposure Index
- AIIC: Australian Inventory of Industrial Chemicals
- DSL: Domestic Substances List
- NDSL: Non-Domestic Substances List
- IECSC: Inventory of Existing Chemical Substance in China
- EINECS: European INventory of Existing Commercial chemical Substances
- ELINCS: European List of Notified Chemical Substances
- NLP: No-Longer Polymers
- ENCS: Existing and New Chemical Substances Inventory
- KECI: Korea Existing Chemicals Inventory
- NZIoC: New Zealand Inventory of Chemicals
- PICCS: Philippine Inventory of Chemicals and Chemical Substances
- TSCA: Toxic Substances Control Act
- TCSI: Taiwan Chemical Substance Inventory
- INSQ: Inventario Nacional de Sustancias Químicas
- NCI: National Chemical Inventory
- FBEPH: Russian Register of Potentially Hazardous Chemical and Biological Substances

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