Safety Data Sheet

Section 1: Identification of the Substance/Mixture and of the Company/Undertaking

1.1 Product identifier

Product Name • **Cobalt Based Alloys**

Synonyms
- Alloy (X); CO (X); Cobalt (X); CoCrMo; ECY(X); F(X); FSX-414; GRADE(X); GX(X); Haynes (X); HS(X); L-605; MAR M (X); MERL (X); MM(X); Nicrallium (x); PT(X); PWA (X); RM-(x); Star (X); Stellite (X); Stoody (X); Triballoy® (x); WI (X); X-(X)

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

Relevant identified use(s)
- Cast ingots at varying weights and dimensions. Ingots are sold and distributed to downstream processors who remelt the superalloys into products used within various downstream applications.

1.3 Details of the supplier of the safety data sheet

Manufacturer
- Stanford Advanced Materials
- E-mail : sales@samaterials.com
- Tel : (949) 407-8904
- Address : 23661 Birtcher Dr., Lake Forest, CA 92630 U.S.A.

Telephone (General) • (949) 407-8904

1.4 Emergency telephone number

Manufacturer • (949) 407-8904

Section 2: Hazards Identification

EU/EEC

According to: Regulation (EC) No 1272/2008 (CLP)/REACH 1907/2006 [amended by 2015/830]

2.1 Classification of the substance or mixture

CLP
- Skin Sensitization 1 - H317
  Respiratory Sensitization 1 - H334
  Carcinogenicity 2 - H351
  Reproductive Toxicity 2 - H361fd
  Specific Target Organ Toxicity Repeated Exposure 1 - H372
  Specific Target Organ Toxicity Repeated Exposure 2 - H373

2.2 Label Elements

CLP

DANGER

Hazard statements

- H317 - May cause an allergic skin reaction
  H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
  H351 - Suspected of causing cancer.
  H361fd - Suspected of damaging fertility. Suspected of damaging the unborn child.
  H372 - Causes damage to organs through prolonged or repeated exposure.
  H373 - May cause damage to organs through prolonged or repeated exposure.

Precautionary statements

Prevention

- P201 - Obtain special instructions before use.
  P202 - Do not handle until all safety precautions have been read and understood.
  P260 - Do not breathe dust or fume.
  P264 - Wash thoroughly after handling.
  P270 - Do not eat, drink or smoke when using this product.
  P272 - Contaminated work clothing should not be allowed out of the workplace.
  P280 - Wear protective gloves/protective clothing/eye protection/face protection.
  P284 - In case of inadequate ventilation wear respiratory protection.

Response

- P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
  P342+P311 - If experiencing respiratory symptoms: Call a POISON CENTER/doctor.
  P302+P352 - IF ON SKIN: Wash with plenty of water.
  P321 - Specific treatment, see supplemental first aid information.
  P362+P364 - Take off contaminated clothing and wash it before reuse.
  P333+P313 - If skin irritation or rash occurs: Get medical advice/attention.
  P308+P313 - IF exposed or concerned: Get medical advice/attention.
  P314 - Get medical advice/attention if you feel unwell.

Storage/Disposal

- P405 - Store locked up.
  P501 - Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

2.3 Other Hazards

CLP

- May form combustible dust concentrations in air.
  Heating above the melting point releases metallic oxides which may cause metal fume fever by inhalation. The symptoms are shivering, fever, malaise and muscular pain.
  According to Regulation (EC) No. 1272/2008 (CLP) this material is considered hazardous.

UN GHS Revision 3

According to: UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS): Third Revised Edition

2.1 Classification of the substance or mixture

UN GHS

- Skin Sensitization 1
  Eye Irritation 2
  Respiratory Sensitization 1
  Carcinogenicity 2
  Reproductive Toxicity 2
  Specific Target Organ Toxicity Repeated Exposure 1

2.2 Label elements

UN GHS

DANGER

Hazard statements

- May cause an allergic skin reaction
  Causes serious eye irritation
  May cause allergy or asthma symptoms or breathing difficulties if inhaled
  Suspected of causing cancer.
  Suspected of damaging fertility or the unborn child.
  Causes damage to organs through prolonged or repeated exposure.

Precautionary statements

Prevention

- Obtain special instructions before use.
  Do not handle until all safety precautions have been read and understood.
  Do not breathe dust or fume.
  Wash thoroughly after handling.
  Do not eat, drink or smoke when using this product.
  Contaminated work clothing should not be allowed out of the workplace.
  Wear protective gloves/protective clothing/eye protection/face protection.
  Use personal protective equipment as required.
  In case of inadequate ventilation wear respiratory protection.

Response

- IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
  If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
  IF ON SKIN: Wash with plenty of soap and water.
  Specific treatment, see supplemental first aid information.
  Wash contaminated clothing before reuse.
  If skin irritation or rash occurs: Get medical advice/attention.
  IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
  If eye irritation persists: Get medical advice/attention.
  IF exposed or concerned: Get medical advice/attention.
  Get medical advice/attention if you feel unwell.

Storage/Disposal

- Store locked up.
  Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

2.3 Other hazards

UN GHS

- May form combustible dust concentrations in air.
  Heating above the melting point releases metallic oxides which may cause metal fume fever by inhalation. The symptoms are shivering, fever, malaise and muscular pain.
  According to the Globally Harmonized System for Classification and Labeling (GHS) this product is considered hazardous

United States (US)

According to: OSHA 29 CFR 1910.1200 HCS

2.1 Classification of the substance or mixture

OSHA HCS 2012

- Skin Sensitization 1
  Eye Irritation 2
  Respiratory Sensitization 1
  Carcinogenicity 2
  Reproductive Toxicity 2
  Specific Target Organ Toxicity Repeated Exposure 1
  Combustible Dust
  Hazards Not Otherwise Classified - Health Hazards - Metal fume fever

2.2 Label elements

OSHA HCS 2012

DANGER

Hazard statements
- May cause an allergic skin reaction
Causes serious eye irritation
May cause allergy or asthma symptoms or breathing difficulties if inhaled
Suspected of causing cancer.
Suspected of damaging fertility or the unborn child.
Causes damage to organs through prolonged or repeated exposure.
May form combustible dust concentrations in air.

Precautionary statements

Prevention
- Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe dust or fume.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Contaminated work clothing should not be allowed out of the workplace.
Wear protective gloves/protective clothing/eye protection/face protection.
In case of inadequate ventilation wear respiratory protection.

Response
- IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
If on skin: Wash with plenty of water .
Specific treatment, see supplemental first aid information.
Wash contaminated clothing before reuse.
If skin irritation or rash occurs: Get medical advice/attention.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists: Get medical advice/attention.
IF exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.

Storage/Disposal
- Store locked up.
Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

2.3 Other hazards

OSHA HCS 2012
- Heating above the melting point releases metallic oxides which may cause metal fume fever by inhalation. The symptoms are shivering, fever, malaise and muscular pain.
Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

Canada

According to: WHMIS 2015

2.1 Classification of the substance or mixture

WHMIS 2015
- Skin Sensitization 1
Eye Irritation 2
Respiratory Sensitization 1
Carcinogenicity 2
Reproductive Toxicity 2
Specific Target Organ Toxicity Repeated Exposure 1
Health Hazards Not Otherwise Classified 1
Combustible Dusts 1

2.2 Label elements

WHMIS 2015

DANGER

Hazard statements
- May cause an allergic skin reaction

Causes serious eye irritation
May cause allergy or asthma symptoms or breathing difficulties if inhaled
Suspected of causing cancer.
Suspected of damaging fertility or the unborn child.
Causes damage to organs through prolonged or repeated exposure.
May form combustible dust concentrations in air.
Heating above the melting point releases metallic oxides which may cause metal fume fever by inhalation. The symptoms are shivering, fever, malaise and muscular pain.

Precautionary statements

Prevention

- Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe dust or fume.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Contaminated work clothing should not be allowed out of the workplace.
Wear protective gloves/protective clothing/eye protection/face protection.
In case of inadequate ventilation wear respiratory protection.

Response

- IF INHALED: Remove person to fresh air and keep comfortable for breathing.
If experiencing respiratory symptoms: Call a POISON CENTER/doctor.
IF ON SKIN: Wash with plenty of water.
Specific treatment, see supplemental first aid information.
Take off contaminated clothing and wash it before reuse.
If skin irritation or rash occurs: Get medical advice/attention.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists: Get medical advice/attention.
IF exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.

Storage/Disposal

- Store locked up.
Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

2.3 Other hazards

WHMIS 2015

- In Canada, the product mentioned above is considered hazardous under the Workplace Hazardous Materials Information System (WHMIS).

Section 3 - Composition/Information on Ingredients

3.1 Substances

- Material does not meet the criteria of a substance.

3.2 Mixtures

Composition					
Chemical Name	**Identifiers**	**%**	**LD50/LC50**	**Classifications According to Regulation/Directive**	**Comments**
Cobalt (powder)	**CAS:**7440-48-4 **EC Number:**231-158-0 **EU Index:**027-001-00-9	35% TO 65%	Ingestion/Oral-Rat LD50 • 6171 mg/kg	**EU CLP:** Annex VI, Table 3.1: Resp. Sens. 1, H334; Skin Sens. 1, H317; Aquatic Chronic 1, H410 (M=1) **UN GHS Revision 3:** Eye Irrit. 2; Resp. Sens. 1; Skin Sens. 1; Carc. 2 (Inhl); STOT RE 2 (Lung / Inhl); Aquatic Acute 2; Aquatic Chronic 2 **OSHA HCS 2012:** Eye Irrit. 2; Resp. Sens. 1; Skin Sens. 1; Carc. 2 (Inhl); STOT RE 2 (Lung / Inhl) **WHMIS 2015:** Eye Irrit. 2; Resp. Sens. 1; Skin Sens. 1; Carc. 2 (Inhl); STOT RE 2 (Lung / Inhl)	NDA
				EU CLP: Annex VI, Table 3.1: Skin Sens. 1, H317;	

Nickel, massive, ≥ 1 mm	**CAS:**7440-02-0 **EC Number:**231-111-4	0% TO 50%	NDA	Carc. 2, H351 (Inhl); STOT RE 1, H372 (Lungs / Orl/Dermal/Inhl); Aquatic Chronic 3, H412 **UN GHS Revision 3:** Flam. Sol. 1; Resp. Sens. 1B; Skin Sens. 1A; Carc. 2 (Inhl); STOT RE 2 (Lungs / Orl, Inhl); Aquatic Acute 3; Aquatic Chronic 3 **OSHA HCS 2012:** Flam. Sol. 1; Comb. Dust; Resp. Sens. 1B; Skin Sens. 1A; Carc. 2 (Inhl); STOT RE 2 (Lungs / Orl, Inhl) **WHMIS 2015:** Flam. Sol. 1; Comb. Dust; Resp. Sens. 1B; Skin Sens. 1A; Carc. 2 (Inhl); STOT RE 2 (Lungs / Orl, Inhl)	NDA
Chromium, massive	**CAS:**7440-47-3 **EC Number:**231-157-5	15% TO 40%	NDA	**EU CLP:** Not Classified **UN GHS Revision 3:** Not Classified **OSHA HCS 2012:** Comb. Dust **WHMIS 2015:** Comb. Dust	NDA
Molybdenum (powder)	**CAS:**7439-98-7 **EC Number:**231-107-2	0% TO 30%	NDA	**EU CLP:** Flam. Sol. 1, H228; Repr. 2, H361 (Orl); Aquatic Chronic 4, H413 **UN GHS Revision 3:** Flam. Sol. 1; Repr. 2 (Orl); Aquatic Chronic 4 **OSHA HCS 2012:** Flam. Sol. 1; Comb. Dust; Repr. 2 (Orl) **WHMIS 2015:** Flam. Sol. 1; Comb. Dust; Repr. 2 (Orl)	NDA
Tungsten, powder	**CAS:**7440-33-7 **EC Number:**231-143-9	0% TO 25%	NDA	**EU CLP:** Flam. Sol. 1, H228; Self-heat. 2; Repr. 2, H361fd (Orl); EUH029 **UN GHS Revision 3:** Flam. Sol. 1; Self-heat. 2; Repr. 2 (Orl) **OSHA HCS 2012:** Flam. Sol. 1; Self-heat. 2; Repr. 2 (Orl) **WHMIS 2015:** Flam. Sol. 1; Self-heat. 2; Repr. 2 (Orl)	NDA
Tantalum	**CAS:**7440-25-7 **EC Number:**231-135-5	0% TO 15%	NDA	**EU CLP:** Acute Tox. 4, H302 **UN GHS Revision 3:** Acute Tox. 4 (Orl) **OSHA HCS 2012:** Acute Tox. 4 (Orl); Comb. Dust **WHMIS 2015:** Acute Tox. 4 (Orl); Comb. Dust	NDA
Iron	**CAS:**7439-89-6 **EC Number:**231-096-4	0% TO 10%		**EU CLP:** Acute Tox. 4, H302; Aquatic Chronic 4, H413 **UN GHS Revision 3:** Acute Tox. 4 (Orl); Aquatic Chronic 4 **OSHA HCS 2012:** Acute Tox. 4 (Orl) **WHMIS 2015:** Acute Tox. 4 (Orl)	NDA
Aluminum powder, stabilized	**CAS:**7429-90-5 **EC Number:**231-072-3	0% TO 6%	NDA	**EU CLP:** Annex VI, Table 3.1: Flam. Sol. 1, H228; Water-react. 2, H261 **UN GHS Revision 3:** Flam. Sol. 1; Water-react. 2; STOT RE 1 (Lungs / Inhl); **OSHA HCS 2012:** Flam. Sol. 1; Water-react. 2; Comb. Dust; STOT RE 1 (Lungs / Inhl) **WHMIS 2015:** Flam. Sol. 1; Water-react. 2; Comb. Dust; STOT RE 1 (Lungs / Inhl)	NDA
Titanium, massive	**CAS:**7440-32-6 **EINECS:**231-142-3	0% TO 5%	NDA	**EU CLP:** Pyr. Sol. 1, H250 **UN GHS Revision 3:** Pyr. Sol. 1 **OSHA HCS 2012:** Pyr. Sol. 1; Comb. Dust **WHMIS 2015:** Pyr. Sol. 1; Comb. Dust	NDA
Silicon	**CAS:**7440-21-3 **EC Number:**231-130-8	0% TO 5%	Ingestion/Oral-Rat LD50 • 3160 mg/kg	**EU CLP:** Flam. Sol. 2, H228 **UN GHS Revision 3:** Flam. Sol. 2; Acute Tox. 5 (Orl) **OSHA HCS 2012:** Flam. Sol. 2 **WHMIS 2015:** Flam. Sol. 2	NDA
Niobium	**CAS:**7440-03-1 **EC Number:**231-113-5	0% TO 3%	NDA	**EU CLP:** Not Classified **UN GHS Revision 3:** Not Classified **OSHA HCS 2012:** Not Classified **WHMIS 2015:** Not Classified	NDA
				EU CLP: Flam. Sol. 2, H228; Eye Irrit. 2, H319; Repr. 2, H361 (Orl); STOT RE 1 (CNS, Lungs / Inhl)	

Manganese (powder)	**CAS:**7439-96-5 **EC Number:**231-105-1	0% TO 3%	Ingestion/Oral-Rat LD50 • 9 g/kg	**UN GHS Revision 3:** Flam. Sol. 2; Skin Irrit. 3; Eye Irrit. 2; Repr. 2 (Orl); STOT RE 1 (CNS, Lungs/ Inhl) **OSHA HCS 2012:** Flam. Sol. 2; Skin Irrit. 3; Eye Irrit. 2; Repr. 2 (Orl); STOT RE 1 (CNS, Lungs/ Inhl); Hazard Not Otherwise Classified - Health Hazard - Metal fume fever **WHMIS 2015:** Flam. Sol. 2; Skin Irrit. 3; Eye Irrit. 2; Repr. 2 (Orl); STOT RE 1 (CNS, Lungs/ Inhl); Hazard Not Otherwise Classified - Health Hazard - Metal fume fever	NDA
Carbon (animal or vegetable origin)	**CAS:**7440-44-0 **EC Number:**231-153-3	0% TO 3%	NDA	**EU CLP:** Not Classified **UN GHS Revision 3:** Pyr. Sol. 1 **OSHA HCS 2012:** Pyr. Sol. 1; Comb. Dust **WHMIS 2015:** Pyr. Sol. 1; Comb. Dust	NDA
Vanadium	**CAS:**7440-62-2 **EC Number:**231-171-1	0% TO 2%	NDA	**EU CLP:** Aquatic Chronic 3, H412 **UN GHS Revision 3:** Aquatic Acute 3; Aquatic Chronic 3 **OSHA HCS 2012:** Not Classified **WHMIS 2015:** Not Classified	NDA
Hafnium	**CAS:**7440-58-6 **EINECS:**231-166-4	0% TO 2%	NDA	**EU CLP:** Eye Irrit. 2 **UN GHS Revision 3:** Eye Irrit. 2; Skin Irrit. 3 **OSHA HCS 2012:** Comb. Dust; Eye Irrit. 2 **WHMIS 2015:** Comb. Dust; Eye Irrit. 2	NDA

See Section 16 for full text of H-statements.

Section 4 - First Aid Measures

4.1 Description of first aid measures

Inhalation
- Move victim to fresh air. Give artificial respiration if victim is not breathing. Administer oxygen if breathing is difficult. If signs/symptoms continue, get medical attention.

Skin
- Wash skin with soap and water. If skin irritation occurs: Get medical advice/attention.

Eye
- In case of contact with substance, immediately flush eyes with running water for at least 20 minutes. If eye irritation persists: Get medical advice/attention.

Ingestion
- Rinse mouth. Do not give anything by mouth to an unconscious person. Get medical attention if symptoms occur.

4.2 Most important symptoms and effects, both acute and delayed

- Refer to Section 11 - Toxicological Information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to Physician
- All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

Section 5 - Firefighting Measures

5.1 Extinguishing media

Suitable Extinguishing Media
- Use dry powder extinguishing agent.

Unsuitable Extinguishing Media
- No data available

5.2 Special hazards arising from the substance or mixture

Unusual Fire and Explosion Hazards
- Metal powder dispersed in air may cause fire and explosion.
Molten metal can ignite combustibles.
Molten metal will react violently with water.

Hazardous Combustion Products
- No data available

5.3 Advice for firefighters

- Wear positive pressure self-contained breathing apparatus (SCBA).
  Structural firefighters' protective clothing will only provide limited protection.

Section 6 - Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures

Personal Precautions
- Ventilate enclosed areas. Do not walk through spilled material. Wear appropriate personal protective equipment, avoid direct contact. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

Emergency Procedures
- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). As an immediate precautionary measure, isolate spill or leak area for at least 25 meters (75 feet) in all directions. If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. Keep unauthorized personnel away.

6.2 Environmental precautions

- Avoid run off to waterways and sewers.

6.3 Methods and material for containment and cleaning up

Containment/Clean-up Measures
- Avoid generating dust.
  Solid ingot material should be picked up and recycled.
  Where possible allow molten material to solidify naturally.
  Residue from cutting or grinding should be swept or vacuumed and placed in suitable containers.
  Use clean nonsparking tools to collect material.
  Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air).

6.4 Reference to other sections

- Refer to Section 8 - Exposure Controls/Personal Protection and Section 13 - Disposal Considerations.

Section 7 - Handling and Storage

7.1 Precautions for safe handling

Handling
- Under normal conditions, exposure to cast ingots presents few health hazards in itself. Ingots may be heavy. Use proper material handling equipment to reduce the risks of strains and sprains. Do not place any part of the body where it might be struck by or caught between the ingot and another object. Thermal cutting and melting of ingots may produce fumes and dust containing the component elements which may present potentially significant health hazards. Use only with adequate ventilation. Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Dry powders can build static electricity charges when subjected to the friction of transfer and mixing operations. Provide adequate precautions, such as electrical grounding and bonding, or inert atmospheres. To avoid possible explosion, ingots need to be clean and dry when loaded into molten metal or preferably loaded into an empty furnace. Nickel can react with carbon monoxide in reducing atmospheres to form nickel carbonyl, an extremely toxic gas. Cobalt causes a dermatitis of the allergic sensitivity type at points in friction. Cobalt toxicity also results in a progressive diffuse, interstitial pneumonia with a non-productive cough, dyspnea on exertion, interstitial fibrosis and cell damage. Other workers have experienced a sensitized respiratory disease characterized by cough, wheezing and shortness of breath where upon removal from the environment, the symptoms subside. Wear appropriate personal protective

equipment, avoid direct contact. Do not breathe dust or fumes. Avoid contact with skin, eyes, and clothing. Wash thoroughly with soap and water after handling and before eating, drinking, or using tobacco.

7.2 Conditions for safe storage, including any incompatibilities

Storage

- Store in a well-ventilated place. Keep container tightly closed. Keep away from incompatible materials.

7.3 Specific end use(s)

- Refer to Section 1.2 - Relevant identified uses.

Section 8 - Exposure Controls/Personal Protection

8.1 Control parameters

Exposure Limits/Guidelines						
	Result	**ACGIH**	**Europe**	**NIOSH**	**OSHA**	**United Kingdom**
Manganese (powder)	STELs	Not established	Not established	3 mg/m3 STEL	Not established	1.5 mg/m3 STEL (calculated)
	TWAs	0.02 mg/m3 TWA (respirable fraction); 0.1 mg/m3 TWA (inhalable fraction)	Not established	1 mg/m3 TWA (fume)	Not established	0.5 mg/m3 TWA (as Mn)
	Ceilings	Not established	Not established	Not established	5 mg/m3 Ceiling (fume)	Not established
Tantalum (7440-25-7)	STELs	Not established	Not established	10 mg/m3 STEL (dust)	Not established	10 mg/m3 STEL
	TWAs	Not established	Not established	5 mg/m3 TWA (dust)	5 mg/m3 TWA	5 mg/m3 TWA
Aluminum powder, stabilized (7429-90-5)	STELs	Not established	Not established	Not established	Not established	30 mg/m3 STEL (calculated, inhalable dust); 12 mg/m3 STEL (calculated, respirable dust)
	TWAs	1 mg/m3 TWA (respirable fraction)	Not established	10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)	10 mg/m3 TWA (inhalable dust); 4 mg/m3 TWA (respirable dust)
Nickel, massive, ≥ 1 mm (7440-02-0)	STELs	Not established	Not established	Not established	Not established	1.5 mg/m3 STEL (calculated)
	TWAs	1.5 mg/m3 TWA (inhalable fraction)	Not established	0.015 mg/m3 TWA	1 mg/m3 TWA	0.5 mg/m3 TWA
Silicon (7440-21-3)	STELs	Not established	Not established	Not established	Not established	30 ppm STEL (calculated, inhalable dust); 12 mg/m3 STEL (calculated, respirable dust)
	TWAs	Not established	Not established	10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)	10 mg/m3 TWA (inhalable dust); 4 mg/m3 TWA (respirable dust)
Tungsten, powder (7440-33-7)	STELs	10 mg/m3 STEL	Not established	10 mg/m3 STEL	Not established	10 mg/m3 STEL
	TWAs	5 mg/m3 TWA	Not established	5 mg/m3 TWA	Not established	5 mg/m3 TWA
				0.05 mg/m3 Ceiling		

Vanadium (7440-62-2)	Ceilings	Not established	Not established	(except Vanadium metal and Vanadium carbide, dust and fume, as V, 15 min) *as Vanadium compounds*	0.5 mg/m3 Ceiling (respirable dust, as V2O5); 0.1 mg/m3 Ceiling (fume, as V2O5)	Not established
	STELs	Not established	Not established	3 mg/m3 STEL (listed under Ferrovanadium dust)	Not established	Not established
	TWAs	Not established	Not established	1 mg/m3 TWA (listed under Ferrovanadium dust)	Not established	Not established
Hafnium (7440-58-6)	TWAs	0.5 mg/m3 TWA	Not established	0.5 mg/m3 TWA	0.5 mg/m3 TWA	Not established
Molybdenum (powder) (7439-98-7)	TWAs	10 mg/m3 TWA (inhalable fraction); 3 mg/m3 TWA (respirable fraction)	Not established	Not established	Not established	Not established
Chromium, massive (7440-47-3)	TWAs	0.5 mg/m3 TWA	2 mg/m3 TWA	0.5 mg/m3 TWA	1 mg/m3 TWA	0.5 mg/m3 TWA
	STELs	Not established	Not established	Not established	Not established	1.5 mg/m3 STEL (calculated)
Cobalt (powder) (7440-48-4)	STELs	Not established	Not established	Not established	Not established	0.3 mg/m3 STEL (calculated)
	TWAs	0.02 mg/m3 TWA	Not established	0.05 mg/m3 TWA (dust and fume)	0.1 mg/m3 TWA (dust and fume)	0.1 mg/m3 TWA

8.2 Exposure controls

Engineering Measures/Controls

- Use a local exhaust when cutting, grinding, welding, or melting. It is recommended that dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product contain explosion relief vents or an explosion supression system or an oxygen-deficient environment. Ensure that dust handling systems (such as exhaust ducts, dust collectors, vessels and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is not leakage from the equipment). Use only appropriately classified electrical equipment.

Personal Protective Equipment

Respiratory

- For limited exposure, use P95 or N95 respirator. For prolonged exposure use an air-purifying respirator with high efficiency particulate air (HEPA) filters. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.

Eye/Face

- Wear safety goggles.

Skin/Body

- Wear appropriate gloves. Wear long sleeves and/or protective coveralls.

Environmental Exposure Controls

- Follow best practice for site management and disposal of waste. Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways.

Key to abbreviations

ACGIH = American Conference of Governmental Industrial Hygiene
NIOSH = National Institute of Occupational Safety and Health
OSHA = Occupational Safety and Health Administration
STEL = Short Term Exposure Limits are based on 15-minute exposures
TWA = Time-Weighted Averages are based on 8h/day, 40h/week exposures

Section 9 - Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Material Description			
Physical Form	Solid	Appearance/Description	Metallic gray solid with no odor.
Color	Metallic gray.	Odor	Odorless
Odor Threshold	Data lacking		
General Properties			
Boiling Point	Data lacking	Melting Point/Freezing Point	2700 °F(1482.2222 °C)
Decomposition Temperature	Data lacking	pH	Data lacking
Specific Gravity/Relative Density	= 8 Water=1	Water Solubility	Negligible < 0.1 %
Viscosity	Data lacking	Explosive Properties	Data lacking
Oxidizing Properties:	Data lacking		
Volatility			
Vapor Pressure	Data lacking	Vapor Density	Data lacking
Evaporation Rate	Data lacking	Volatiles (Wt.)	0 %
Volatiles (Vol.)	0 %		
Flammability			
Flash Point	Data lacking	UEL	Data lacking
LEL	Data lacking	Autoignition	Data lacking
Flammability (solid, gas)	Data lacking		
Environmental			
Octanol/Water Partition coefficient	Data lacking		

9.2 Other Information

- No additional physical and chemical parameters noted.

Section 10: Stability and Reactivity

10.1 Reactivity

- No dangerous reaction known under conditions of normal use.

10.2 Chemical stability

- Stable under normal temperatures and pressures.

10.3 Possibility of hazardous reactions

- Hazardous polymerization will not occur.

10.4 Conditions to avoid

- Avoid generating dust.

10.5 Incompatible materials

- Cast Ingot is stable at ordinary temperature, however, caution should be taken with acids, bases, and oxidizers. Molten metal will react violently with water.

10.6 Hazardous decomposition products

- Under normal conditions, exposure to cast ingots presents few health hazards in itself. Thermal cutting and melting of ingots may produce fumes containing the component elements and breathing those fumes may present potentially significant health hazards.

Section 11 - Toxicological Information

11.1 Information on toxicological effects

Components		
Nickel, massive, ≥ 1 mm (0% TO 50%)	7440-02-0	**Acute Toxicity:** Ingestion/Oral-Rat TDLo • 200 mg/kg; *Nutritional and Gross Metabolic:Gross Metabolite Changes*:**Weight loss or decreased weight gain**; *Behavioral*:**Somnolence (general depressed activity)**; **Multi-dose Toxicity:** Ingestion/Oral-Rat TDLo • 500 mg/kg 5 Day(s)-Intermittent; *Lungs, Thorax, or Respiration*:**Fibrosis, focal (pneumoconiosis)**; *Related to Chronic Data*:**Death in the Other Multiple Dose data type field**; Inhalation-Rabbit TCLo • 1 mg/m³ 6 Hour(s) 13 Week(s)-Intermittent; *Lungs, Thorax, or Respiration*:**Other changes**; *Lungs, Thorax, or Respiration*:**Changes in lung weight**; *Blood*:**Hemorrhage**; Inhalation-Rat TCLo • 0.4 mg/m³ 40 Week(s)-Intermittent; *Vascular*:**Thrombosis distant from injection site**; *Lungs, Thorax, or Respiration*:**Other changes**; *Related to Chronic Data*:**Death in the Other Multiple Dose data type field**; **Reproductive:** Ingestion/Oral-Rat TDLo • 158 mg/kg (multigenerations); *Reproductive Effects:Effects on Embryo or Fetus*:**Fetotoxicity (except death, e.g., stunted fetus)**; *Reproductive Effects:Effects on Embryo or Fetus*:**Fetal death**; **Tumorigen / Carcinogen:** Inhalation-Guinea Pig TCLo • 15 mg/m³ 91 Week(s)-Intermittent; *Tumorigenic*:**Equivocal tumorigenic agent by RTECS criteria**; *Lungs, Thorax, or Respiration*:**Tumors**; *Lungs, Thorax, or Respiration*:**Bronchiogenic carcinoma**
Manganese (powder) (0% TO 3%)	7439-96-5	**Acute Toxicity:** Ingestion/Oral-Rat LD50 • 9 g/kg; **Irritation:** Eye-Rabbit • 500 mg 24 Hour(s) • Mild irritation; Skin-Rabbit • 500 mg 24 Hour(s) • Mild irritation; **Multi-dose Toxicity:** Inhalation-Human TCLo • 0.5 mg/m³ 39 Week(s)-Intermittent; *Brain and Coverings*:**Other degenerative changes**; *Peripheral Nerve and Sensation*:**Sensory change involving peripheral nerve**; *Behavioral*:**Irritability**; Inhalation-Mouse TCLo • 0.7 mg/m³ 24 Hour(s) 22 Week(s)-Continuous; *Lungs, Thorax, or Respiration*:**Fibrosis (interstitial)**; *Immunological Including Allergic*:**Decrease in cellular immune response**; Inhalation-Rat TCLo • 0.3 mg/m³ 5 Hour(s) 26 Week(s)-Intermittent; *Lungs, Thorax, or Respiration*:**Fibrosis (interstitial)**; *Immunological Including Allergic*:**Decrease in cellular immune response**; **Reproductive:** Ingestion/Oral-Mouse TDLo • 322.5 mg/kg (43D male); *Reproductive Effects:Paternal Effects*:**Spermatogenesis**; Ingestion/Oral-Rat TDLo • 50 mg/kg (20D post); *Reproductive Effects:Specific Developmental Abnormalities*:**Central nervous system**; *Reproductive Effects:Effects on Newborn*:**Biochemical and metabolic**; *Reproductive Effects:Effects on Newborn*:**Behavioral**; Ingestion/Oral-Rat TDLo • 90 mg/kg (18D post); *Reproductive Effects:Effects on Newborn*:**Growth statistics (e.g., reduced weight gain)**; *Reproductive Effects:Effects on Newborn*:**Biochemical and metabolic**; *Reproductive Effects:Effects on Newborn*:**Other postnatal measures or effects**
Titanium, massive (0% TO 5%)	7440-32-6	**Reproductive:** Ingestion/Oral-Rat TDLo • 158 mg/kg (multigeneration); *Reproductive Effects:Effects on Embryo or Fetus*:**Fetotoxicity (except death, e.g., stunted fetus)**; *Reproductive Effects:Effects on Embryo or Fetus*:**Fetal death**
Cobalt (powder) (35% TO 65%)	7440-48-4	**Acute Toxicity:** Ingestion/Oral-Rat LD50 • 6171 mg/kg; *Behavioral*:**Somnolence (general depressed activity)**; *Behavioral*:**Ataxia**; *Gastrointestinal*:**Hypermotility, diarrhea**; **Multi-dose Toxicity:** Inhalation-Rabbit TCLo • 10 mg/m³ 2 Hour(s) 56 Day(s)-Intermittent; *Behavioral*:**Food intake (animal)**; *Lungs, Thorax, or Respiration*:**Emphysema**; *Liver*:**Fatty liver degeneration**; Inhalation-Rat TCLo • 0.09 mg/m³ 24 Hour(s) 8 Week(s)-Continuous; *Lungs, Thorax, or Respiration*:**Other changes**; *Kidney, Ureter, and Bladder*:**Urine volume decreased**; *Biochemical:Enzyme inhibition, induction, or change in blood or tissue levels*:**Dehydrogenases**; Inhalation-Rat TCLo • 2 mg/m³ 4 Day(s)-Intermittent; *Lungs, Thorax, or Respiration*:**Fibrosing alveolitis**
Aluminum powder, stabilized (0% TO 6%)	7429-90-5	**Multi-dose Toxicity:** Inhalation-Man TCLo • 4 mg/m³ 1 Year(s)-Intermittent; *Lungs, Thorax, or Respiration*:**Cough**; *Lungs, Thorax, or Respiration*:**Dyspnea**; *Nutritional and Gross Metabolic:Gross Metabolite Changes*:**Weight loss or decreased weight gain**; Inhalation-Rat TCLo • 206 mg/m³ 5 Hour(s) 30 Day(s)-Intermittent; *Lungs, Thorax, or Respiration*:**Fibrosis (interstitial)**; *Endocrine*:**Hypoglycemia**; *Blood*:**Changes in serum composition (e.g., TP, bilirubin cholesterol)**
Tungsten, powder (0% TO 25%)	7440-33-7	**Irritation:** Eye-Rabbit • 500 mg 24 Hour(s) • Mild irritation; Skin-Rabbit • 500 mg 24 Hour(s) • Mild irritation; **Reproductive:** Ingestion/Oral-Rat TDLo • 1160 µg/kg (30W pre/1-20D preg); *Reproductive Effects:Specific Developmental Abnormalities*:**Musculoskeletal system**; Ingestion/Oral-Rat TDLo • 1210 µg/kg (35W pre); *Reproductive Effects:Effects on Fertility*:**Post-implantation mortality**; *Reproductive Effects:Specific Developmental Abnormalities*:**Musculoskeletal system**
Tantalum (0% TO 15%)	7440-25-7	**Acute Toxicity:** Ingestion/Oral-Mouse LD50 • 595 mg/kg
Silicon (0% TO 5%)	7440-21-3	**Acute Toxicity:** Ingestion/Oral-Rat LD50 • 3160 mg/kg; **Irritation:** Eye-Rabbit • 3 mg • Mild irritation

Vanadium (0% TO 2%)	7440-62-2	**Multi-dose Toxicity:** Ingestion/Oral-Rat TDLo • 225 mg/kg 15 Day(s)-Continuous; *Nutritional and Gross Metabolic:Gross Metabolite Changes*:**Weight loss or decreased weight gain**
Iron (0% TO 10%)	7439-89-6	**Acute Toxicity:** Ingestion/Oral-Rat LD50 • 750 mg/kg; *Blood*:**Changes in serum composition (e.g., TP, bilirubin cholesterol)**; *Biochemical:Enzyme inhibition, induction, or change in blood or tissue levels*:**Transaminases**; Ingestion/Oral-Child TDLo • 77 mg/kg; *Behavioral*:**Irritability**; *Gastrointestinal*:**Nausea or vomiting**; *Blood*:**Normocytic anemia**; **Multi-dose Toxicity:** Ingestion/Oral-Rat TDLo • 105 mg/kg 5 Week(s)-Continuous; *Liver*:**Tumors**; *Tumorigenic*:**Active as anti-cancer agent**; *Tumorigenic*:**Protects against induction of experimental tumors**
Molybdenum (powder) (0% TO 30%)	7439-98-7	**Mutagen:** Cytogenetic analysis • Inhalation-Rat • 19500 µg/m³; **Reproductive:** Ingestion/Oral-Mouse TDLo • 448 mg/kg (multigenerations); *Reproductive Effects:Effects on Embryo or Fetus*:**Fetotoxicity (except death, e.g., stunted fetus)**; *Reproductive Effects:Effects on Embryo or Fetus*:**Fetal death**; Ingestion/Oral-Rat TDLo • 5800 µg/kg (30W pre/1-20D preg); *Reproductive Effects:Specific Developmental Abnormalities*:**Musculoskeletal system**; Ingestion/Oral-Rat TDLo • 6050 µg/kg (35W pre); *Reproductive Effects:Effects on Fertility*:**Pre-implantation mortality**; *Reproductive Effects:Effects on Fertility*:**Post-implantation mortality**; *Reproductive Effects:Specific Developmental Abnormalities*:**Musculoskeletal system**

GHS Properties	Classification
Acute toxicity	**EU/CLP** • Data lacking **UN GHS 3** • Data lacking **OSHA HCS 2012** • Data lacking **WHMIS 2015** • Data lacking
Skin corrosion/Irritation	**EU/CLP** • Data lacking **UN GHS 3** • Data lacking **OSHA HCS 2012** • Data lacking **WHMIS 2015** • Data lacking
Serious eye damage/Irritation	**EU/CLP** • Data lacking **UN GHS 3** • Eye Irritation 2 **OSHA HCS 2012** • Eye Irritation 2 **WHMIS 2015** • Eye Irritation 2
Skin sensitization	**EU/CLP** • Skin Sensitizer 1 **UN GHS 3** • Skin Sensitizer 1 **OSHA HCS 2012** • Skin Sensitizer 1 **WHMIS 2015** • Skin Sensitizer 1
Respiratory sensitization	**EU/CLP** • Respiratory Sensitizer 1 **UN GHS 3** • Respiratory Sensitizer 1 **OSHA HCS 2012** • Respiratory Sensitizer 1 **WHMIS 2015** • Respiratory Sensitizer 1
Aspiration Hazard	**EU/CLP** • Data lacking **UN GHS 3** • Data lacking **OSHA HCS 2012** • Data lacking **WHMIS 2015** • Data lacking
Carcinogenicity	**EU/CLP** • Carcinogenicity 2; Suspected of causing cancer **UN GHS 3** • Carcinogenicity 2 **OSHA HCS 2012** • Carcinogenicity 2 **WHMIS 2015** • Carcinogenicity 2
Germ Cell Mutagenicity	**EU/CLP** • Data lacking **UN GHS 3** • Data lacking **OSHA HCS 2012** • Data lacking **WHMIS 2015** • Data lacking

Toxicity for Reproduction	**EU/CLP** • Toxic to Reproduction 2 **UN GHS 3** • Toxic to Reproduction 2 **OSHA HCS 2012** • Toxic to Reproduction 2 **WHMIS 2015** • Toxic to Reproduction 2
STOT-SE	**EU/CLP** • Data lacking **UN GHS 3** • Data lacking **OSHA HCS 2012** • Data lacking **WHMIS 2015** • Data lacking
STOT-RE	**EU/CLP** • Specific Target Organ Toxicity Repeated Exposure 1; Specific Target Organ Toxicity Repeated Exposure 2 **UN GHS 3** • Specific Target Organ Toxicity Repeated Exposure 1 **OSHA HCS 2012** • Specific Target Organ Toxicity Repeated Exposure 1 **WHMIS 2015** • Specific Target Organ Toxicity Repeated Exposure 1

Potential Health Effects

Inhalation

Acute (Immediate)
- Processes such as cutting, grinding, crushing, or impact may result in generation of excessive amounts of airborne dusts in the workplace. Nuisance dust may affect the lungs but reactions are typically reversible.

Chronic (Delayed)
- Repeated and prolonged exposure may cause sensitization of the respiratory system. Following sensitization of the respiratory system, cobalt exposure causes an obstructive lung disease with wheezing, cough, and shortness of breath. Chronic respiratory exposure results in reduced lung function, increased fibrotic changes on chest X-ray, production of scanty mucoid sputum, and shortness of breath. Chronic exposure to Nickel can cause effects such as rhinitis, sinusitis, nasal septal perforations and asthma have been reported in nickel refinery and nickel plating workers.

Skin

Acute (Immediate)
- Exposure to dust may cause mechanical irritation. May cause skin sensitization. Symptoms include redness, and skin rash. Contact allergy to nickel is very common in human beings.

Chronic (Delayed)
- No data available.

Eye

Acute (Immediate)
- Causes serious eye irritation. Excessive concentrations of nuisance dust in the workplace may reduce visibility and may cause unpleasant deposits in eyes.

Chronic (Delayed)
- No data available.

Ingestion

Acute (Immediate)
- Excessive concentrations of nuisance dust in the workplace may cause mechanical irritation to mucous membranes.

Chronic (Delayed)
- No data available.

Carcinogenic Effects
- Repeated and prolonged exposure to fumes and dust created in processing this product may cause cancer.

Carcinogenic Effects			
	CAS	**IARC**	**NTP**
Nickel, massive, ≥ 1 mm	7440-02-0	Group 2B-Possible Carcinogen	Reasonably Anticipated to be Human Carcinogen
Cobalt (powder)	7440-48-4	Group 2B-Possible Carcinogen	Not Listed

Reproductive Effects
- Repeated and prolonged exposure to fumes and dust created in processing this product may cause reproductive effects.

11.2 Other information

- Heating above the melting point releases metallic oxides which may cause metal fume fever by inhalation. The symptoms are shivering, fever, malaise and muscular pain.

Key to abbreviations

LD = Lethal Dose
TC = Toxic Concentration
TD = Toxic Dose

Section 12 - Ecological Information

12.1 Toxicity

Components		
Nickel, massive, ≥ 1 mm (0% TO 50%)	7440-02-0	**Aquatic Toxicity-Fish:** 96 Hour(s) LC50 *Oncorhynchus mykiss (Rainbow Trout)* 0.06 mg/L 28 Day(s) NOEC *Cyprinus carpio (Common Carp)* 0.0035 µg/L **Aquatic Toxicity-Crustacea:** 7 Day(s) NOEC *Americamysis bahia (Opossum Shrimp)* 0.213 mg/L **Aquatic Toxicity-Algae and Other Aquatic Plant(s):** 96 Hour(s) EC50 *Pseudokirchneriella subcapitata (Green Algae)* 0.233 mg/L
Cobalt (powder) (35% TO 65%)	7440-48-4	**Aquatic Toxicity-Fish:** 96 Hour(s) LC50 *Pimephales promelas (Fathead Minnow)* 3.4 mg/L **Aquatic Toxicity-Crustacea:** 48 Hour(s) LC50 *Daphnia magna (Water Flea)* 4.4 mg/L 28 Day(s) NOEC *Daphnia magna (Water Flea)* 0.0028 mg/L
Vanadium (0% TO 2%)	7440-62-2	**Aquatic Toxicity-Fish:** 96 Hour(s) LC50 *Pimephales promelas (Fathead Minnow)* 1.8 mg/L **Aquatic Toxicity-Crustacea:** 48 Hour(s) LC50 *Daphnia magna (Water Flea)* 1.55 mg/L 7 Day(s) NOEC *Daphnia magna (Water Flea)* 0.5 mg/L
Iron (0% TO 10%)	7439-89-6	**Aquatic Toxicity-Fish:** 96 Hour(s) LC50 *Mudskipper(Periophthalmus waltoni)* 0.00648 mg/L 7 Day(s) NOEC *Brown Trout (Salmo trutta)* 0.305 mg/L **Aquatic Toxicity-Crustacea:** 7 Day(s) NOEC *Aquatic Sowbug, Isopod (Idotea balthica)* 0.5 mg/L
Molybdenum (powder) (0% TO 30%)	7439-98-7	**Aquatic Toxicity-Fish:** 96 Hour(s) LC50 *Rainbow Trout (Oncorhynchus mykiss)* 800 mg/L **Aquatic Toxicity-Crustacea:** 48 Hour(s) LC50 *Daphnia magna (Water Flea)* >200 mg/L 28 Day(s) NOEC *Daphnia magna (Water Flea)* 0.67 mg/L

- Product in ingot form is non-toxic to aquatic and terrestrial organisms.

12.2 Persistence and degradability

- The product is persistent and would have low degradability.

12.3 Bioaccumulative potential

- Material data lacking.

12.4 Mobility in Soil

- A low mobility would be expected in a landfill situation.

12.5 Results of PBT and vPvB assessment

- No PBT and vPvB assessment has been conducted.

12.6 Other adverse effects

- No studies have been found.

Section 13 - Disposal Considerations

13.1 Waste treatment methods

Product waste
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Packaging waste
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Section 14 - Transport Information

	14.1 UN number	14.2 UN proper shipping name	14.3 Transport hazard class(es)	14.4 Packing group	14.5 Environmental hazards
DOT	Not Applicable	Not Regulated	Not Applicable	Not Applicable	NDA
TDG	Not Applicable	Not Regulated	Not Applicable	Not Applicable	NDA
IMO/IMDG	Not Applicable	Not Regulated	Not Applicable	Not Applicable	NDA
IATA/ICAO	Not Applicable	Not Regulated	Not Applicable	Not Applicable	NDA

14.6 Special precautions for user
- None specified.

14.7 Transport in bulk according to Annex II of Marpol and the IBC Code
- Data lacking.

Section 15 - Regulatory Information

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

SARA Hazard Classifications
- Acute, Chronic, Pressure(Sudden Release of)

Inventory						
Component	**CAS**	**Canada DSL**	**Canada NDSL**	**EU EINECS**	**EU ELNICS**	**TSCA**
Aluminum powder, stabilized	7429-90-5	Yes	No	Yes	No	Yes
Carbon (animal or vegetable origin)	7440-44-0	Yes	No	Yes	No	Yes
Chromium, massive	7440-47-3	Yes	No	Yes	No	Yes
Cobalt (powder)	7440-48-4	Yes	No	Yes	No	Yes
Hafnium	7440-58-6	Yes	No	Yes	No	Yes
Iron	7439-89-6	Yes	No	Yes	No	Yes
Manganese (powder)	7439-96-5	Yes	No	Yes	No	Yes
Molybdenum (powder)	7439-98-7	Yes	No	Yes	No	Yes
Nickel, massive, ≥ 1 mm	7440-02-0	Yes	No	Yes	No	Yes
Niobium	7440-03-1	Yes	No	Yes	No	Yes
Silicon	7440-21-3	Yes	No	Yes	No	Yes
Tantalum	7440-25-7	Yes	No	Yes	No	Yes
Titanium, massive	7440-32-6	Yes	No	Yes	No	Yes
Tungsten, powder	7440-33-7	Yes	No	Yes	No	Yes
Vanadium	7440-62-2	Yes	No	Yes	No	Yes

Canada

Labor

Canada - WHMIS - Classifications of Substances

• Hafnium	7440-58-6	Uncontrolled product according to WHMIS classification criteria

• Carbon (animal or vegetable origin)	7440-44-0	Uncontrolled product according to WHMIS classification criteria
• Chromium, massive	7440-47-3	Uncontrolled product according to WHMIS classification criteria
• Manganese (powder)	7439-96-5	D2A (including powder)
• Tantalum	7440-25-7	Uncontrolled product according to WHMIS classification criteria
• Cobalt (powder)	7440-48-4	D2A, D2B
• Aluminum powder, stabilized	7429-90-5	B6 (powder); Uncontrolled product according to WHMIS classification criteria
• Molybdenum (powder)	7439-98-7	Uncontrolled product according to WHMIS classification criteria
• Nickel, massive, ≥ 1 mm	7440-02-0	D2A, D2B; B6, D2A (Raney)
• Silicon	7440-21-3	B4
• Tungsten, powder	7440-33-7	Uncontrolled product according to WHMIS classification criteria
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Uncontrolled product according to WHMIS classification criteria
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

Canada - WHMIS - Ingredient Disclosure List

• Hafnium	7440-58-6	1 %
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	0.1 %
• Manganese (powder)	7439-96-5	1 %
• Tantalum	7440-25-7	1 %
• Cobalt (powder)	7440-48-4	0.1 %
• Aluminum powder, stabilized	7429-90-5	1 %
• Molybdenum (powder)	7439-98-7	1 %
• Nickel, massive, ≥ 1 mm	7440-02-0	0.1 %
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	1 %
• Vanadium	7440-62-2	1 %
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

Environment

Canada - CEPA - Priority Substances List

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed

• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

United States

Labor

U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

U.S. - OSHA - Specifically Regulated Chemicals

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

Environment

U.S. - CAA (Clean Air Act) - 1990 Hazardous Air Pollutants

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed

• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed
U.S. - CERCLA/SARA - Hazardous Substances and their Reportable Quantities		
• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	5000 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is >100 µm); 2270 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is >100 µm)
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	100 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is >100 µm); 45.4 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is >100 µm)
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed
U.S. - CERCLA/SARA - Radionuclides and Their Reportable Quantities		
• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed

• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances EPCRA RQs

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances TPQs

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

U.S. - CERCLA/SARA - Section 313 - Emission Reporting

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	1.0 % de minimis concentration
• Manganese (powder)	7439-96-5	1.0 % de minimis concentration
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	0.1 % de minimis concentration
• Aluminum powder, stabilized	7429-90-5	1.0 % de minimis concentration (dust or fume only)
• Molybdenum (powder)	7439-98-7	Not Listed

• Nickel, massive, ≥ 1 mm	7440-02-0	0.1 % de minimis concentration
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	1.0 % de minimis concentration (except when contained in an alloy)
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

U.S. - CERCLA/SARA - Section 313 - PBT Chemical Listing

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

United States - California

Environment

U.S. - California - Proposition 65 - Carcinogens List

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	carcinogen, 7/1/1992 (powder)
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	carcinogen, 10/1/1989 (metallic)
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

U.S. - California - Proposition 65 - Developmental Toxicity

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed

• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

U.S. - California - Proposition 65 - Maximum Allowable Dose Levels (MADL)

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

U.S. - California - Proposition 65 - No Significant Risk Levels (NSRL)

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

U.S. - California - Proposition 65 - Reproductive Toxicity - Female

• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed

• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed
U.S. - California - Proposition 65 - Reproductive Toxicity - Male		
• Hafnium	7440-58-6	Not Listed
• Carbon (animal or vegetable origin)	7440-44-0	Not Listed
• Chromium, massive	7440-47-3	Not Listed
• Manganese (powder)	7439-96-5	Not Listed
• Tantalum	7440-25-7	Not Listed
• Cobalt (powder)	7440-48-4	Not Listed
• Aluminum powder, stabilized	7429-90-5	Not Listed
• Molybdenum (powder)	7439-98-7	Not Listed
• Nickel, massive, ≥ 1 mm	7440-02-0	Not Listed
• Silicon	7440-21-3	Not Listed
• Tungsten, powder	7440-33-7	Not Listed
• Vanadium	7440-62-2	Not Listed
• Iron	7439-89-6	Not Listed
• Titanium, massive	7440-32-6	Not Listed
• Niobium	7440-03-1	Not Listed

15.2 Chemical Safety Assessment

- No Chemical Safety Assessment has been carried out.

15.3 Other Information

- WARNING: This product contains a chemical known to the State of California to cause cancer.

Section 16 - Other Information

Relevant Phrases (code & full text)

- H228 - Flammable solid
  H251 - Self-heating; may catch fire
  H260 - In contact with water releases flammable gases which may ignite spontaneously
  H302 - Harmful if swallowed
  H361 - Suspected of damaging fertility or the unborn child.
  H413 - May cause long lasting harmful effects to aquatic life

Revision Date

- 08/March/2018

Preparation Date

- 24/February/2016

Disclaimer/Statement of Liability

- The information herein is given in good faith but no warranty, expressed or implied, is made.

Key to abbreviations

NDA = No Data Available