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Revision Number 0

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

GHS product identifier

Product Name Chromium-Nickel Alloyed Stainless Steel grades

Other means of identification

Synonyms 301, 302, 303, 304(L), 305, 308, 309, 310, 314, 321, 347, 415, F6NM, UNS S41003, 1.4306, 153MA®, 253MA® and Outokumpu 2304. This includes all listed grades with letter prefixes and suffixes as well as PRODEC® suffix, with the exception of 303Cu, 304Cu, UNS S30430, 310MoLN.

Recommended use of the chemical and restrictions on use

Recommended Use Solid stainless steel products, various forms, and uses

Uses advised against No information available

Supplier's details

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

Emergency telephone number

Emergency Telephone Number (949) 407-8904

2. HAZARDS IDENTIFICATION

Classification

This chemical is not considered hazardous according to the OSHA Hazard Communication Standard 2012 (29 CFR 1910.1200). Solid metallic products are generally classified as "articles" and do not constitute hazardous materials in solid form. However, downstream use of the article could result in some hazardous elements contained in these products to be emitted under certain processing conditions such as but not limited to : burning, melting, cutting, sawing, brazing, grinding, machining, milling, and welding.

GHS Label elements, including precautionary statements

No labeling applicable

Hazard Not Otherwise Classified (HNOC)

Not applicable

Other information

No information

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms

301, 302, 303, 304(L), 305, 308, 309, 310, 314, 321, 347, 415, F6NM, UNS S41003, 1.4306, 153MA®, 253MA® and Outokumpu 2304. This includes all listed grades with letter prefixes and suffixes as well as PRODEC® suffix, with the exception of 303Cu, 304Cu, UNS S30430, 310MoLN.

Chemical Name	CAS-No	Weight %	Trade secret
Iron	7439-89-6	Balance	*
Nickel	7440-02-0	1.5-37	*
Chromium	7440-47-3	11.5-26	*
Silicon	7440-21-3	0-2	*
Manganese	7439-96-5	0-2	*
Molybdenum	7439-98-7	0-1	*
Titanium	7440-32-6	0-0.7	*
Copper	7440-50-8	0-0.6	*
Cobalt	7440-48-4	0-0.6	*

*The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

Description of necessary first-aid measures

General Advice

In its solid form stainless steel does not present an inhalation, absorption, or ingestion hazard. Grinding, polishing, abrasive blasting, hot rolling, hot forging, thermal cutting, or welding may produce stainless steel dust or fumes containing complex or mixed oxides (spinel) of its components. Metal dust particles may cause eye, skin and/or respiratory system irritation. The below information is for these instances.

Eye Contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

Skin Contact

Wash off immediately with soap and plenty of water. In the case of skin irritation or allergic reactions see a physician.

Inhalation

Move to fresh air. If breathing is difficult, give oxygen. Consult a physician.

Ingestion

Not an expected route of exposure. If swallowed: Get medical attention.

Most important symptoms/effects, acute and delayed

Most Important Symptoms/Effects

During processing: Coughing and/ or wheezing. Difficulty in breathing. Irritation. May cause allergic skin reaction.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to Physician

May cause sensitization by inhalation and skin contact. Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media None

Specific Hazards Arising from the Chemical

Avoid dust formation. Dust can form an explosive mixture in air. May cause sensitization by inhalation and skin contact.

Explosion Data

Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Avoid dust formation. Avoid inhalation of dust. Ensure adequate ventilation. In case of insufficient ventilation wear suitable respiratory equipment. Use personal protective equipment. Avoid contact with skin, eyes and clothing.

Environmental Precautions

Environmental Precautions Not applicable to steel in solid state. Follow applicable federal, state and local regulations

Methods and materials for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so. Cover dust spill with plastic sheet or tarp to minimize spreading.

Methods for Cleaning Up Take up mechanically and collect in suitable container for disposal. Avoid dust formation. Clean contaminated surface thoroughly.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice. Avoid dust formation. Avoid breathing dust. Avoid contact with skin, eyes and clothing. Wear personal protective equipment. Do not eat, drink or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage Store in accordance with local regulations.

Incompatible Products May react in contact with strong acids to release gaseous acid decomposition products, e.g. hydrogen, oxides of nitrogen. Use of strong oxidizers (high pH) on stainless steel may cause Cr(VI) compounds to form at ambient temperatures. Decomposition: Fumes generated during welding, brazing, or thermal cutting may contain: chromium compounds, including hexavalent chromium Cr(VI); nickel; manganese; iron; molybdenum; and silicon compounds.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

Exposure Guidelines

There are no occupational exposure limits for stainless steels. Occupational exposure limits apply to some components resulting from grinding, polishing, abrasive blasting, hot rolling, hot forging, thermal cutting, or welding which may produce stainless steel dust or fumes.

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Nickel 7440-02-0	TWA: 1.5 mg/m ³	TWA: 1 mg/m ³ (vacated) TWA: 1 mg/m ³	IDLH: 10 mg/m ³ TWA: 0.015 mg/m ³
Silicon 7440-21-3	-	TWA: 15 mg/m ³ total dust TWA: 5 mg/m ³ respirable fraction (vacated) TWA: 10 mg/m ³ total dust (vacated) TWA: 5 mg/m ³ respirable fraction	TWA: 10 mg/m ³ total dust TWA: 5 mg/m ³ respirable dust
Manganese 7439-96-5	TWA: 0.2 mg/m ³	(vacated) TWA: 1 mg/m ³ fume (vacated) STEL: 3 mg/m ³ fume (vacated) Ceiling: 5 mg/m ³ fume Ceiling: 5 mg/m ³ fume	IDLH: 500 mg/m ³ TWA: 1 mg/m ³ fume STEL: 3 mg/m ³
Molybdenum 7439-98-7	TWA: 10 mg/m ³ inhalable fraction TWA: 3 mg/m ³ respirable fraction	(vacated) TWA: 10 mg/m ³	IDLH: 5000 mg/m ³
Copper 7440-50-8	TWA: 0.2 mg/m ³ fume	TWA: 0.1 mg/m ³ fume TWA: 1 mg/m ³ dust and mist (vacated) TWA: 0.1 mg/m ³ Cu dust, fume, mist	IDLH: 100 mg/m ³ dust, fume and mist TWA: 1 mg/m ³ dust and mist TWA: 0.1 mg/m ³ fume
Cobalt 7440-48-4	TWA: 0.02 mg/m ³	TWA: 0.1 mg/m ³ dust and fume (vacated) TWA: 0.05 mg/m ³ dust and fume	IDLH: 20 mg/m ³ dust and fume TWA: 0.05 mg/m ³ dust and fume

Appropriate engineering controls

Engineering Measures

Ensure adequate ventilation, especially in confined area (i.e. showers, eyewash stations, etc.).

Individual protection measures, such as personal protective equipment

Eye/Face Protection

When processing the metal alloy wear: Tightly fitting safety goggles.

Skin and Body Protection

When processing the metal alloy: Wear protective gloves/clothing.

Respiratory Protection

If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Solid	Appearance	Varying from dull very light grey, to shiny metallic light grey to bright mirror-finish
Odor	Odorless	Odor Threshold	No information available

<u>Property</u>	<u>Values</u>	<u>Remarks/ - Method</u>
pH	No data available	None known
Melting Point/Range	1370-1520 °C / 2498-2768 °F	None known
Boiling Point/Boiling Range	No data available	None known
Flash Point	No data available	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known

Flammability Limits in Air

upper flammability limit	No data available	
lower flammability limit	No data available	
Vapor Pressure	No data available	None known
Vapor Density	No data available	None known
Relative Density	No data available	None known
Specific Gravity	No data available.	None known
Water Solubility	No data available	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition Temperature	No data available	None known
Decomposition Temperature	No data available	None known
Viscosity	No data available	None known

Flammable Properties Not flammable

Explosive Properties No data available
Oxidizing Properties No data available

Other information

VOC Content (%) No data available

10. STABILITY AND REACTIVITY

Reactivity

No data available.

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

None under normal processing.

Conditions to avoid

Dust formation.

Incompatible materials

May react in contact with strong acids to release gaseous acid decomposition products, e.g. hydrogen, oxides of nitrogen. Use of strong oxidizers (high pH) on stainless steel may cause Cr(VI) compounds to form at ambient temperatures. Decomposition: Fumes generated during welding, brazing, or thermal cutting may contain: chromium compounds, including hexavalent chromium Cr(VI); nickel; manganese; iron; molybdenum; and silicon compounds.

Hazardous decomposition products

None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure**Product Information**

In its solid form stainless steel does not present an inhalation, absorption, or ingestion hazard. Grinding, polishing, abrasive blasting, hot rolling, hot forging, thermal cutting, or welding may produce stainless steel dust or fumes containing complex or mixed oxides (spinel) of its components. Metal dust particles may cause eye, skin and/or respiratory system irritation. The below information is for these instances.

Inhalation May cause irritation of respiratory tract. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Eye Contact Contact with eyes may cause irritation.

Skin Contact Contact with dust can cause mechanical irritation or drying of the skin. Repeated or prolonged skin contact may cause allergic reactions with susceptible persons.

Ingestion May cause irritation

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Iron	= 984 mg/kg (Rat)	-	-
Nickel	> 9000 mg/kg (Rat)	-	-
Silicon	= 3160 mg/kg (Rat)	-	-
Manganese	= 9 g/kg (Rat)	-	-
Cobalt	= 6170 mg/kg (Rat)	-	> 10 mg/L (Rat) 1 h

Symptoms related to the physical, chemical and toxicological characteristics

Symptoms No information available.

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

Sensitization During processing: May cause sensitization by inhalation and skin contact

Mutagenic Effects No information available.

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA
Nickel		Group 2B Group 1	Reasonably Anticipated	X
Chromium		Group 3		
Cobalt	A3	Group 2A Group 2B		X

Reproductive Toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure Causes damage to organs through prolonged or repeated exposure.

Chronic Toxicity Elevated temperature processing such as welding and plasma arc cutting may release hazardous fumes. Overexposure to metal fumes may cause pulmonary edema (fluid in the lungs) and methemoglobinemia. May also cause pulmonary fibrosis and lung cancer. Chronic exposure to manganese may cause impairment to the central nervous system including sluggishness, sleepiness, muscle weakness, loss of facial muscle control, edema, emotional disturbances, spastic gait, and falling.

Target Organ Effects Respiratory system. Skin.

Aspiration Hazard No information available.

Numerical measures of toxicity - Product

The following values are calculated based on chapter 3.1 of the GHS document:

LD50 Oral 389 mg/kg; Acute toxicity estimate 7500

12. ECOLOGICAL INFORMATION

Ecotoxicity

The environmental impact of this product has not been fully investigated.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
Iron	-	LC50 96 h: = 0.56 mg/L semi-static (Cyprinus carpio) LC50 96 h: = 13.6 mg/L static (Morone saxatilis)	-	-

Nickel	EC50 96 h: 0.174 - 0.311 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: = 0.18 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 1.3 mg/L semi-static (Cyprinus carpio) LC50 96 h: = 10.4 mg/L static (Cyprinus carpio) LC50 96 h: > 100 mg/L (Brachydanio rerio)	-	EC50 48 h: = 1 mg/L Static (Daphnia magna) EC50 48 h: > 100 mg/L (Daphnia magna)
Cobalt	-	LC50 96 h: > 100 mg/L static (Brachydanio rerio)	-	-
Copper	EC50 96 h: 0.031 - 0.054 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: 0.0426 - 0.0535 mg/L static (Pseudokirchneriella subcapitata)	LC50 96 h: 0.0068 - 0.0156 mg/L (Pimephales promelas) LC50 96 h: < 0.3 mg/L static (Pimephales promelas) LC50 96 h: = 0.052 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 0.112 mg/L flow-through (Poecilia reticulata) LC50 96 h: = 0.2 mg/L flow-through (Pimephales promelas) LC50 96 h: = 0.3 mg/L semi-static (Cyprinus carpio) LC50 96 h: = 0.8 mg/L static (Cyprinus carpio) LC50 96 h: = 1.25 mg/L static (Lepomis macrochirus)	-	EC50 48 h: = 0.03 mg/L Static (Daphnia magna)

Persistence and Degradability No information available.

Bioaccumulation No information available.

Other Adverse Effects
No information available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods Recover or recycle if possible. Dispose of in accordance with federal, state, and local regulations

Contaminated Packaging Dispose of in accordance with federal, state, and local regulations.

Chemical Name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Nickel - 7440-02-0	(hazardous constituent - no waste number)	Included in waste streams: F006, F039		
Chromium - 7440-47-3		Included in waste streams: F032, F034, F035, F037, F038, F039	5.0 mg/L regulatory level	
Chemical Name		California Hazardous Waste		
Nickel		Toxic powder Ignitable powder		
Chromium		Toxic Corrosive Ignitable		
Manganese		Ignitable powder		
Molybdenum		Ignitable powder		
Titanium		Ignitable powder		
Copper		Toxic		
Cobalt		Toxic powder Ignitable powder		

14. TRANSPORT INFORMATION

DOT Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
 DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

U.S. Federal Regulations

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372:

Chemical Name	CAS-No	Weight %	SARA 313 - Threshold Values %
Nickel	7440-02-0	1.5-37	0.1
Chromium	7440-47-3	11.5-26	1.0
Manganese	7439-96-5	0-2	1.0
Cobalt	7440-48-4	0-0.6	0.1

SARA 311/312 Hazard Categories

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

This product contains the following substances which are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42):

Chemical Name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Nickel		X	X	
Copper		X	X	

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302):

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Nickel	100 lb		RQ 100 lb final RQ RQ 45.4 kg final RQ
Chromium			RQ 5000 lb final RQ RQ 2270 kg final RQ
Copper	5000 lb		RQ 5000 lb final RQ RQ 2270 kg final RQ

U.S. State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals:

Chemical Name	CAS-No	California Prop. 65
Nickel	7440-02-0	Carcinogen
Cobalt	7440-48-4	Carcinogen

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania	Illinois	Rhode Island
Nickel	X	X	X	X	X
Chromium		X			X
Silicon	X	X	X		X
Manganese	X	X	X	X	X
Molybdenum	X	X	X		X
Titanium	X				
Cobalt	X	X	X	X	X

U.S. EPA Label Information

EPA Pesticide Registration Number Not applicable

16. OTHER INFORMATION

<u>NFPA</u>	Health Hazard 0	Flammability 0	Instability 0	Physical and Chemical Hazards -
<u>HMIS</u>	Health Hazard 0	Flammability 0	Physical Hazard 0	Personal Protection X

Prepared By Stanford Advanced Materials

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General Disclaimer

The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet