

MATERIAL SAFETY DATA SHEET

SECTION 1 – PRODUCT IDENTIFICATION

Product Name: **431 Stainless Steel Powder**
 Product Item: **235431**
 Product Code: **HA 5431**

Supplier: **HAI Advanced Material Specialists, Inc.**
1688 Sierra Madre Circle
Placentia, CA 92870
(714)-414-0575

Emergency Contact: (888) 255 3924 – Toll free
 Chemical Family: Metal
 Formula: Stainless Steel
 Molecular Weight:-

SECTION 2 – HAZARDOUS INGREDIENTS

IMPORTANT! This section covers the material from which these products are manufactured. Dust and gases produced when spraying with normal use of these products are covered in Section 5.

Material or Component	CAS Number	Concentration	OSHA PEL	ACGIH TLV	Other Limits *
Iron	7439-89-6	0 - 100 %	NE	NE	NE
Chromium	7440-47-3	0 - 25 %	1 mg/m ³	0.5 mg/m ³	NE
Nickel	7440-02-0	0 - 25 %	1.0 mg/m ³	1.5 mg/m ³	NE
Molybdenum	7439-98-7	0 - 5 %	No data	10 mg/m ³	5 bmg/m ³
Manganese	7439-96-5	0 - 5 %	1 mg/m ³	0.2 mg/m ³	NE
Silicon	7440-21-3	0 - 5 %	15 mg/m ³	10 mg/m ³	5mg/m ³ resp.
Boron	7440-42-8	0 - 5 %	NE	NE	NE
Carbon	7440-44-0	0 - 2%	15 mg/m ³	NE	NE

Material or Component	RTECS #	OSHA STEL	OSHA CEIL	ACGIH STEL	ACGIH STEL
Iron	NO4565500	No data	No data	No data	No data
Chromium	GB4200000	No data	No data	No data	No data
Nickel	QR5950000	No data	No data	No data	No data
Molybdenum	QA4680000	No data	No data	No data	No data
Manganese	OO9275000	No data.	5 mg/m ³	No data.	No data.
Silicon	No data	No data	No data	No data	No data
Boron	ED7350000	No data	No data	No data	No data
Carbon	FF5250100	No data	No data	No data	No data

US EPA SARA TITLE III

Material or Component	CAS Number	Sec. 302 (EHS)	Sec. 304 RQ	Sec. 313 (TRI)
Iron	7439-89-6	No	No	No
Chromium	7440-47-3	No	Yes 5000 LB	Yes
Nickel	7440-02-0	No	Yes 100 lb	Yes
Molybdenum	7439-98-7	No	No	No
Manganese	7439-96-5	No	No	Yes
Silicon	7440-21-3	No	No	No
Boron	7440-42-8	No	No	No
Carbon	7440-44-0	No	No	No

SECTION 3 – PHYSICAL/CHEMICAL CHARACTERISTICS

Physical States: Gas Liquid Solid
Melting Point: 1494 - 1545°C
Boiling Point: N/A
Specific gravity (water=1): 7.5 – 8.5 g/cm³
Vapor pressure (mmHg): N/A
Vapor Density (Air=1): N/A
Evaporation rate (Butylacetate=1): N/A
Solubility in water: insoluble
Percent volatile (vol.): N/A
Corrosion Rate: No data
Appearance and odor: gray powder, odorless.
Other: None

SECTION 4 – FIRE AND EXPLOSION HAZARD DATA

Flash point: N/A Method Used: Unknown
Auto ignition temp.: None reported for alloy but metal powders can burn and form explosive mixtures in air.
Flammable limits: N/A
Explosive Limits: LEL: N/A UEL: N/A
Extinguishing Media: Do not use water or halon. Use dry sand, dry dolomite, or dry graphite powder or other dry chemical extinguishing agent formulated for metal fires.
Special fire fighting procedures: Firefighters must wear full face, self-contained breathing apparatus with full protective clothing to prevent contact with skin and eyes. Fumes from fire are hazardous. Isolate runoff to prevent environmental pollution. Material may dry out and present additional fire/explosion hazards. Remove sources of heat or ignition as dust clouds can burn or explode.
Unusual fire and explosion hazards: Powder may burn. Dust is an explosion hazard.
Hazardous Combustion Products: Toxic metal oxides, carbon and nitrogen oxides may be produced during a fire involving metal alloys. Alloys with nickel may also produce toxic nickel carbonyl.

SECTION 5 – REACTIVITY DATA

<u>Stability:</u>	Unstable [] Stable [X]
<u>Conditions to avoid - Instability:</u>	none
<u>Incompatibility – Materials to avoid:</u>	Reacts with strong acids and caustics to form flammable and explosive hydrogen gas. Contact with sulfure may cause evolution of heat. Contact with halogenated compounds and oxidizers may produce violent reactions and fires.
<u>Hazardous decomposition products:</u>	Toxic metal oxides and carbon and nitrogen oxides may be produced during a fire involving metal alloys. Alloys with nickel may also produce poisonous nickel carbonyl.
<u>Hazardous polymerization:</u>	Will occur [] Will not occur [X]
<u>Conditions to avoid – Hazardous polymerization:</u>	None
<u>Product corrosive:</u>	Yes [] No [X]

SECTION 6 – HEALTH HAZARD DATA

Health Hazards (Acute and Chronic)

To the best of our knowledge the chemical, physical and toxicological properties of Molybdenum-Nickel self-fluxing alloy have not been thoroughly investigated and recorded.

Iron: Is of varying toxicity. Exposure to iron oxides is potentially a serious risk in all industrial settings. Some iron compounds are suspected carcinogens. In general, ferrous compounds are more toxic than ferric compounds. Acute exposure to excessive levels of ferrous compounds can cause liver and kidney damage, altered respiratory rates, and convulsions. (Sax, Dangerous Properties of Industrial Materials, eighth edition)

Chromium: Confirmed human carcinogen with experimental tumorigenic data. Human poison by ingestion with gastrointestinal effects. (Sax, Dangerous Properties of Industrial Materials)

Nickel: Confirmed carcinogen with experimental carcinogenic, neoplastic, tumorigenic and teratogenic data. Poison by ingestion, intratracheal, intraperitoneal, subcutaneous and intravenous routes. An experimental teratogenic. Ingestion of soluble salts causes nausea, vomiting and diarrhea. Hypersensitivity to nickel is common and can cause allergic contact dermatitis, pulmonary asthma, conjunctivitis and inflammatory reactions around nickel containing medical implants and prosthesis. (Sax, Dangerous Properties of industrial Materials, eighth edition)

Molybdenum compounds are poison by subcutaneous and intraperitoneal routes. Molybdenum and its compounds are highly toxic based upon animal experiments. Symptoms of acute poisoning include severe gastrointestinal irritation with diarrhea, coma and deaths from heart failure. Experimental animals exposed to high levels accumulated Mo in the lungs spleen, and heart, and showed a decrease of DNA and RNA in the liver, kidneys and spleen. (Sax, Dangerous Properties of Industrial Materials, eighth edition)

Manganese: Some manganese compounds are experimental tumorigens. They can cause central nervous and pulmonary system damage by inhalation of fumes and dust. Very few poisonings have occurred from ingestion. Chronic manganese poisoning is a clearly characterized disease which results from inhalation of fumes or dusts of manganese. The central nervous system is the chief site of damage. Exposure to dusts and fumes can possibly increase the incidence of upper respiratory infections and pneumonia. (Sax, Dangerous Properties of Industrial Materials, eighth edition)

Silicon: To the best of our knowledge the chemical, physical and toxicological properties of silicon have not been thoroughly investigated and recorded.

Boron: Boron compounds are very toxic and therefore considered an industrial poison. Boron is one of a group of elements, such as Pb, Mn, As, which effects the central nervous system. Boron poisoning causes depression of the circulation, persistent vomiting and diarrhea, followed by profound shock and coma. The temperature becomes subnormal and a scarletina form rash may cover the entire body. (Sax, Dangerous Properties of Industrial Materials, eighth edition)

Carbon: To the best of our knowledge the chemical, physical and toxicological properties of carbon have not been thoroughly investigated and recorded.

Acute (Immediate) Effects:

- Inhalation:** Inhalation of metal powder may cause chills, fever, sweating, nausea, and cough (symptoms of metal fume fever). Metal fume fever symptoms typically begin within 4 to 12 hours after the initial exposure and lasts for approximately 24 hours without causing permanent damage. Other effects may include nose and throat irritation, metallic taste, difficulty breathing, wheezing, and chest pain. Alloys with high concentrations of chromium may cause headache, coughing, shortness of breath, nasal irritation, pneumoconiosis, and fever. Alloys with nickel and/or manganese may cause coughing, difficulty breathing and shortness of breath, rapid breathing, and chest tightness.
- Ingestion:** Ingestion of small amounts may occur through eating, smoking, or other hand to mouth contact. Ingestion of small amounts is unlikely to cause significant health effects, but alloys containing high concentrations of chromium may cause severe gastrointestinal irritation, kidney system damage, and circulatory shock. Alloys with high concentrations of copper or nickel may cause nausea, vomiting, stomach pain, and diarrhea. Ingestion of large amounts of copper dust can lead to gastrointestinal tract ulceration, jaundice, and kidney damage.
- Skin:** May cause skin irritation and dermatitis especially in creases of the skin where dust may accumulate and rub against skin. Some individuals may become sensitized from repeated contact with metal powders, especially alloys containing copper and nickel. Nickel alloys may cause "nickel itch", reddened ulcerated skin: and sensitization to nickel..
- Eye:** May cause eye irritation and/or conjunctivitis. May cause eye discoloration.

Chronic (Long Term) Effects:

Effects of long term or repeated exposure to metal powders may include respiratory disease, pneumoconiosis, bronchial asthma, lung fibrosis, obstructive airway syndrome, and possibly cancer, depending on the alloy components. Alloys that contain **cobalt or nickel** may cause sensitization and allergic dermatitis. **Nickel** may cause hardened, leathery skin upon chronic overexposure. Long term or repeated overexposure to nickel by inhaling nickel-containing dust may cause lung irritation, thickening of the mucous membranes of the nose, sinus inflammation, loss of the sense of smell, and perforation of the nasal septum. Chronic inhalation overexposures to nickel may also cause cancer of the nasal passages, larynx, and lung. Long term or repeated overexposure to **iron** dust can cause siderosis, a "benign" pneumoconiosis. Repeated or long term ingestion of large quantities of iron may result in fibrosis of the pancreas, diabetes mellitus, liver cirrhosis, and cardiac poisoning. Chronic overexposures to **manganese** dust and fume may affect the central nervous system and cause headache, restless sleep, personality changes, lack of coordination, irritability, uncontrolled and inappropriate laughing or crying, visual hallucinations, double vision. Impulsive behavior, euphoria, excess salivation, mental confusion, impaired walking, trembling in the extremities and head, and other symptoms similar to Parkinson's Disease. Excessive ingestion of **molybdenum** may cause a copper deficiency.

Target Organs:

Respiratory tract, skin, eyes. Long term exposure to some components may affect the central nervous system (manganese), kidney (cobalt, copper, manganese), bladder (cobalt), liver (copper), blood (manganese), nasal cavities (chromium, nickel), and pancreas (iron). Molybdenum may affect the lungs, bones, spleen, respiratory system, nervous system, liver, blood and heart.

Carcinogenicity: NTP? [Yes] ARC Monographs? [Yes] OSHA Regulated? [Yes]

Carcinogenicity / other Information:

OSHA, IARC, or NTP lists components of some alloys as carcinogens. Chromium metal is listed as IARC Class 3 (not classifiable as carcinogenic to humans). Chromium VI is classified as IARC-1, (carcinogenic to humans), and NTP -1 (known to be a human carcinogen). Other Chromium compounds are listed with an IARC-3 (not classifiable as to carcinogenicity to humans). Elemental cobalt is listed as carcinogenic in animal experimentation by the IARC (Class 2B). Nickel is classified as IARC 2B, possibly carcinogenic to humans, and as NTP-2, reasonably anticipated to be a carcinogen.

The IARC, NTP, or OSHA do not list the following metals used in the alloys as carcinogens – Carbon, copper, iron, manganese, tungsten, boron, molybdenum, silicon.

May contain trace elements of hexavalent chromium (<0.1%). Local ventilation may be necessary when handling material – especially if material is heated.

Iron Other Toxicity Data

itr-rat TDLO: 450 mg/kg/15W-I:ETA orl-rat LD50: 30 g/kg
ipr-rbt LDLO: 20 mg/kg

Chromium Other Toxicity Data

ivn-rat TDLO: 2160 ug/kg/6W-I:ETA imp-rat TDLO: 1200 ug/kg/6WI TFX:ETA orl-hmn LDLo: 71 mg/kg:GIT imp-rbt TDLo: 75 mg/kg: ETA

Nickel Other Toxicity Data

otr-ham:kdy 400 mg/L orl-rat TDLo: 158 mg/kg (MGN):TER
otr-ham:emb 5 umol/L acu-rat TDLo: 3000 mg/kg/6W-I:ETA
ims-rat TDLo: 56 mg/kg:CAR par-rat TDLo: 40 mg/kg/52W-I:ETA
imp-rat TDLo: 250 mg/kg:CAR ims-mus TDLo: 200mg/kg:NEO
imp-rbt TDLo: 165 mg/kg/2Y-I:NEO,TER orl-rat LDLo: 5 g/kg
itr-rat LDLo: 12mg/kg ivn-mus LDLo: 50 mg/kg
ivn-dog LDLo: 10mg/kg scu-rat LDLo: 12500 ug/kg
ipr-rbt LDLo: 7 mg/kg scu-rbt LDLo: 7500 ug/kg
orl-gpg LDLo: 5mg/kg

Molybdenum Other Toxicity Data

cyt-rat-ihl 19500 ug/m3 orl-mus TDLO: 448 mg/kg (multi):TER
ipr-rat LDLO: 114 mg/kg itr-rbt LDLO: 70 mg/kg
orl-rat TDLO: 6050 ug/kg (female 35W pre):REP

Manganese Other Toxicity Data

orl-rat LD50: 9 gm/kg
skn-rbt 500 mg/24H MLD eye-rbt 500 mg/24H MLD
mrc-smc 8 mmol/L/18H ims-rat TDLO: 400 mg/kg/1Y-I:ETA
ihl-man TCLO: 2300 ug/m3:BRN,CNS
orl-rat LD50: 9000 mg/kg

Silicon Other Toxicity Data

orl-rat LD50: 3160 mg/kg
Standard Draize Test Rabbit: 3 mg mild reaction

Boron Other Toxicity Data

orl-mus LD50: 2000 mg/kg; orl-mam LD50: 300 mg/kg

Carbon Other Toxicity Data

No toxicity data recorded

Recommended Exposure Limits See "Section II"

LD 50 / LC 50 See "Carcinogenicity / other Information"

Signs and Symptoms of Exposure

Inhalation: May cause red, dry or sore nose and throat. Coughing and shortness of breath may also occur.

Ingestion: Acute molybdenum poisoning may cause severe gastrointestinal irritation, diarrhea, coma, and death from cardiac failure. Chronic molybdenum poisoning as seen in animals may cause: loss of weight, anorexia, anemia, deficient lactation, male sterility, osteoporosis and bone-joint abnormalities. Nickel toxicity may cause: gastroenteritis; nervous symptoms such as tremor, chorea-like movements and paralysis occur prior to death, which occurs mostly from heart failure.

Skin: May cause redness, burning, and itching.

Eye: May cause redness, burning, itching and watering.

Medical Conditions Generally Aggravated by Exposure

Pre-existing respiratory disorders, pulmonary functions, asthma and skin disorders.

Emergency and First Aid Procedures

Inhalation: Remove victim to fresh air; keep warm and quiet; give oxygen if breathing is difficult and seek medical attention.

Ingestion: Give 1-2 glasses of milk or water and induce vomiting; seek medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

Skin: Remove contaminated clothing; brush material off skin; wash affected area with mild soap and water; seek medical attention if symptoms persist.

Eye: Flush eyes with lukewarm water, lifting upper and lower eyelids, for at least 15 minutes. Seek medical attention if symptoms persist.

SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE/DISPOSAL

Steps to be Taken in Case Material is Released or Spilled

Wear appropriate respiratory and protective equipment specified in section VIII-control measures. Isolate spill area and provide ventilation. Vacuum up spill using a high efficiency particulate absolute (HEPA) air filter and place in a closed container for proper disposal. Take care not to raise dust.

Waste Disposal Method

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

Hazard Label information

Store in cool, dry area Store in tightly sealed container Wash thoroughly after handling

Precautions to be Taken in Handling

Prevent contact with high heat or acids.

Precautions to be Taken in Storing

Store in dry cool place, and be sure container is sealed closed.

Other Precautions

None recorded.

SECTION 8 - CONTROL MEASURES

Protective Equipment Summary - Hazard Label Information:

NIOSH approved respirator Impervious gloves Safety glasses Clothes to prevent skin contact

Respiratory Equipment (Specify Type)

NIOSH - approved dust, mist, fume cartridge respirator

Eye Protection

Safety glasses

Protective Gloves

Rubber gloves

Other Protective Clothing

Protective gear suitable to prevent contamination

Ventilation

Local Exhaust: minimum face velocity of 60 f.p.m, to maintain concentration at or below PEL, TLV

Special: Handle in a controlled, enclosed process

Mechanical (Gen): Not recommended

Other: None

Work/Hygienic/Maintenance Practices

Implement engineering and work practice controls to reduce and maintain concentration of exposure at low levels.

Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating and smoking. Do not blow dust off clothing or skin with compressed air.

SECTION 9 – Transport Information

U.S. Department of Transportation (DOT) regulations - 49 Code of Federal Regulations (CFR)

NON-BULK (shipped in packages less than or equal to 400 kg gross weight):

Shipping Name: UN 3077, Environmentally Hazardous Substance Solid, n.o.s., Class 9, III

Marking and Labeling Packages:

- Text: "Environmentally Hazardous Substance, Solid, n.o.s. UN 3077 RQ (contains nickel)"
- Label: Class 9
- List Consignor or Consignee's name and address

Placarding:

- Not required for domestic non-bulk shipments of Class 9 materials [49 CFR 172.504(f)(9)]. Hazardous substances are not regulated internationally so it would never be necessary to placard a non-bulk shipment.

BULK (shipped in packages greater than 400 kg gross weight):

Shipping Name: UN 3077, Environmentally Hazardous Substance Solid, n.o.s., Class 9, III

Marking and Labeling Packages:

Intermediate bulk container (IBC) packages must show the following markings and labels on 2 opposing sides if IBC capacity is > 450 L.

- Text: "Environmentally Hazardous Substance, Solid, n.o.s. UN 3077 RQ (contains nickel)"
- Label: Class 9 and UN Number Marking 3077 (orange panel) or Class 9 placard with the UN Number 3077.
- List Consignor or Consignee's name and address

SECTION 10 – OTHER

Control of Substances Hazardous to Health Regulations
EH40 Occupational Exposure Limits

Maximum Exposure Limit: NE
Occupational Exposure Standard: NE

HAI Advanced Material Specialists, Inc. request the users of this product to study this Material Safety Data Sheet (MSDS) and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify its employees, agents, and contractors of the information on this MSDS and any product hazard and safety information, (2) furnish this same information to each of its customers for the product, and (3) request such customers to notify their employees and customers for the product of the product hazards and safety information.

Company Policy or Disclaimer

The above information is accurate to the best of our knowledge. However, since data, safety standards, and government regulations are subject to change, and the conditions of handling and use or misuse are beyond our control, HAI MAKES NO WARRANTY, EITHER EXPRESSED NOR IMPLIED, WITH RESPECT TO THE COMPLETENESS OR CONTINUING ACCURACY OF THE INFORMATION CONTAINED HEREIN, AND DISCLAIMS ALL LIABILITY FOR RELIANCE THEREON. Users should satisfy themselves that they have all current data relevant to their particular use.

Abbreviations used: N/A=Not Applicable NE: Not Established