

SAFETY DATA SHEET



Section 1 – PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Carbon Steel and Low Alloy Covered Electrodes

PRODUCT IDENTIFICATION: ROYAL 200 | ROYAL 205 | ROYAL 208 | ROYAL 270

SPECIFICATION: N/A

RECOMMENDED USE: SMAW (Shielded Metal Arc Welding)

SUPPLIER: Crown Alloys Company
 30105 Stephenson Hwy.
 Madison Heights, MI. 48071

TELEPHONE NUMBER: (248) 588-3790

EMERGENCY NUMBER: (800) 255-3924 (CHEMTREC)

WEBSITE: www.crownalloys.com

Section 2 – HAZARDS IDENTIFICATION

2.1 Classification of the mixture

This product is placed on the market in solid form

2.1.1 Classification in accordance with GHS-US

Acute Tox. 4 (Oral)	H302	STOT SE 3	H336
Skin Irrit. 2	H315	Carc. 1B	H350
Skin Sens. 1	H317	STOT RE 1	H372
Eye Irrit. 2A	H319	Aquatic Acute 1	H400
STOT SE 3	H335	Aquatic Chronic 3	H412

2.2 Label elements

GHS-US labelling

Hazard Pictograms (GHS-US):



GHS07



GHS08



GHS09

Signal word (GHS-US):

Danger

Hazard statements (GHS-US):

- | | |
|--|---|
| H302 – Harmful if swallowed | H336 – May cause drowsiness or dizziness |
| H317 – May cause an allergic skin reaction | H350 – May cause cancer |
| H315 – Causes skin irritation | H372 – Causes damage to organs through prolonged or repeated exposure |
| H319 – Causes serious eye irritation | H400 – Very toxic to aquatic life |
| H335 – May cause respiratory irritation | H412 – Harmful to aquatic life with long lasting effects |

Precautionary statements (GHS-US):

- | | |
|--|---|
| P201 – Obtain special instructions before use | P403+P233 – Store in a well-ventilated place. Keep container tightly closed. |
| P202 – Do not handle until all safety precautions have been read and understood | P302+P352 – IF ON SKIN: Wash with plenty of soap and water |
| P260 – Do not breathe dust/fume/gas/mist/vapors/spray | P308+P313 – IF EXPOSED OR CONCERNED: Get medical advice/attention |
| P261 – Avoid breathing dust/fume/gas/mist/vapors/spray | P314 – Get medical advice and attention if you feel unwell |
| P264 – Wash thoroughly after handling | P321 – Specific treatment (see label) |
| P270 – Do not eat, drink or smoke when using this product | P330 – If swallowed, rinse mouth |
| P272 – Contaminated work clothing should not be allowed out of the workplace | P333+P313 – If skin irritation or rash occurs: Get medical advice/attention |
| P273 – Avoid release to the environment | P362+P364 – Take off contaminated clothing and wash it before reuse |
| P280 – Wear protective gloves/protective clothing/eye protection/face protection | P391 – Collect spillage |
| P301+P312 – If swallowed: Call a poison center or physician if you feel unwell | P405 – Store locked up |
| | P501- Dispose of contents/container in accordance with local/regional/national/international regulations |
| | P305+P351+P338 – If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. |
| | P337+P313 – If eye irritation persists: Get medical advice/attention |

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2.3 Other hazards

No additional information available

2.4 Unknown acute toxicity (GHS-US)

No data available

Other hazards which do not result in GHS classification:

Electrical shock can kill.
Arc rays can injure eyes and burn skin.
Welding arc and sparks can ignite combustibles and flammable materials.
Overexposure to welding fumes and gases can be hazardous.
Read and understand the manufacturer's instructions, Safety Data Sheets and the precautionary labels before using these alloys. Refer to Section 8.

Substance(s) formed under the conditions of use:

The welding fumes produced from these welding alloys may contain the following constituent(s) and/or their complex metallic oxides as well as solid particles or other constituents from the consumables, base metal, or base metal coating not listed below:

Chemical Identity	CAS-No.	Chemical Identity	CAS-No.	Chemical Identity	CAS-No.
Carbon Dioxide	124-38-9	Ozone	10028-15-6	Nickel	7440-02-0
Carbon Monoxide	630-08-0	Manganese	7439-96-5	Chromium Oxide	1308-38-9
Nitrogen Dioxide	10102-44-0	Chromium (VI)	18540-29-9	Fluorides (as F)	16984-48-8

Section 3 – COMPOSITION / INFORMATION ON INGREDIENTS

3.1 Substances

Not applicable

Full text of H-phrases: See section 16

3.2 Mixture

Reportable Hazardous Ingredients

Chemical Identity	CAS-No.	Weight Percent (%)	GHS-US Classification
Chromium and chromium alloys or compounds (as Cr)	7440-47-3	1.00 max.	Comb. Dust
Iron (Fe)	7439-89-6	60.0 – 98.0	Acute Tox. 4 (Oral), H302
Manganese (Mn)	7439-96-5	0.50 – 5.00	Comb. Dust
Molybdenum (Mo)	7439-98-7	1.00 max.	Comb. Dust
Nickel (Ni)	7440-02-0	1.50 max.	Skin Sens. 1, H317 Carc. 1B, H350 STOT RE 1, H372
Silicon (Si)	7440-21-3	1.15 max.	Not classified
Titanium (Ti)	7440-32-6	0.17 max.	Not classified

Other components which may be present: **Flux**

Barium carbonate	513-77-9	10.0 max.	Harmful if swallowed, R22
Calcium carbonate, Limestone (CaCO ₃)	1317-65-3	13.00 max.	Not classified
Calcium fluoride (Fluorspar) (CaF ₂)	7789-75-5	13.00 max.	Not classified
Cellulose	9004-34-6	5.00 max.	
Feldspar	68476-25-5	5.00 max.	Not classified
Graphite	7782-42-5	5.00 max.	Not classified
Kaolin	1332-58-7	7.00 max.	Not classified
Lithium aluminum silicate	12068-40-5	5.00 max.	Not classified
Potassium silicate (K ₂ SiO ₃)	1312-76-1	5.00 max.	Acute Tox. 4 (Oral), H302
Silica (quartz) (SiO ₂)	14808-60-7	0.05 – 1.00	Carc. 1A, H350 STOT RE 1, H372
Sodium silicate (Na ₂ Si ₆ O ₉)	1344-09-8	0.05 – 5.00	Acute Tox. 4 (Oral), H302
Titanium dioxide (TiO ₂)	13463-67-7	0.10 – 30.0	Carc. 2, H351

Composition Comments: The term "Hazardous Ingredients" should be interpreted as a term defined in Hazard Communication standards and does not necessarily imply the existence of a welding hazard. These alloys may contain additional non-hazardous ingredients or may form additional compounds under the condition of use. Refer to Sections 2 & 8 for more information.

Section 4 – FIRST AID MEASURES

4.1 Description of first aid measures

Ingestion: Unlikely due to the form of the product. Avoid hand, clothing, food, and drink contact with metal fume or powder which can cause ingestion of particulate during hand to mouth activities such as drinking, eating, smoking, etc. If ingested, do not induce vomiting. Contact a poison control center. If symptoms develop, seek medical attention at once.

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Seek medical assistance immediately.

Skin Contact: Flush with water for at least 15 minutes. For reddened or blistered skin, or thermal burns, obtain medical assistance.

Eye Contact: Dust or fume from these alloys should be flushed from the eyes with clean, tepid water until transported to a medical facility. Do not rub eyes or keep eyes tightly closed. Obtain immediate medical assistance.
Arc rays can injure eyes. If exposed, move victim to a dark room, remove contact lenses and cover eyes with a padded dressing and rest. Obtain medical assistance if symptoms persist.

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4.2 Most important symptoms/effects, acute and delayed

Symptoms/injuries after inhalation:	No adverse effects are expected from welding consumables until they are welded. Hexavalent chromium compounds, nickel metal and compounds and respirable crystalline silica are listed in the National Toxicology Program (NTP) Annual Report on Carcinogens, and are found to be a human carcinogen in the International Agency for Research on Cancer (IARC) Monographs, and are listed by OSHA/ACGIH as potential carcinogens. Short-term (acute) overexposure to the gases, fumes, and dusts may include irritation of the eyes, lungs, nose, and throat. Some toxic gases associated with welding may cause pulmonary edema, asphyxiation, and death. Acute overexposure may include signs and symptoms such as watery eyes, nose and throat irritation, headache, dizziness, difficulty in breathing, frequent coughing, or chest pain. The presence of chromium/chromate in fume can cause irritation of nasal membranes and skin. The presence of nickel compounds in fume can cause metallic taste, nausea, tightness of chest, fever, and allergic reaction. Excessive inhalation or ingestion of manganese can produce manganese poisoning. Overexposure to manganese compounds may affect the central nervous system, symptoms of which are languor, sleepiness, muscular weakness, emotional disturbances, and spastic gait resembling Parkinsonism. These symptoms can become progressive and permanent if not treated. Excessive inhalation of fumes may cause "Metal Fume Fever" with Flu-like symptoms such as chills, fever, body aches, vomiting, sweating, etc.
Symptoms/injuries after skin contact:	Dusts may cause irritation.
Symptoms/injuries after eye contact:	Causes eye irritation.
Symptoms/injuries after ingestion:	Not an anticipated route of exposure during normal product handling. May be harmful if ingested.

4.3 Indication of immediate medical attention and special treatment needed

No additional information available

Section 5 – FIRE-FIGHTING MEASURES

General Fire Hazards: As shipped, this product is nonflammable. However, welding arc and sparks can ignite combustibles and flammable products. Read and understand American National Standard Z49.1, "Safety In Welding, Cutting and Allied Processes" and National Fire Protection Association NFPA 51B, "Standard for Fire Prevention During Welding, Cutting and Other Hot Work" before using this product.

5.1 Extinguishing media

Suitable extinguishing media:	Use extinguishing media appropriate for surrounding fire.
Unsuitable extinguishing media:	None

5.2 Special hazards arising from the substance

Fire hazard:	Not flammable.
Explosion hazard:	None known.

5.3 Special protective equipment and precautions for firefighters

Special firefighting procedures:	Use standard firefighting procedures and consider the hazards of other involved materials.
Special protective equipment for firefighters:	Firefighters should wear full protective gear.

Section 6 – ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

If airborne dust and/or fume is present, use adequate engineering controls and, if needed, personal protection to prevent overexposure. Refer to recommendations in Section 8.

6.2 Environmental precautions

Avoid release to the environment

6.3 Methods and material for containment and cleaning up

Clean up spills immediately, observing precautions in the personal protective equipment in Section 8. Avoid generating dust. Prevent product from entering any drains, sewers or water sources. Refer to Section 13 for proper disposal. Attempt to reclaim the product if possible.

Section 7 – HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid inhaling welding fumes. Keep formation of airborne dusts to a minimum. Provide appropriate exhaust ventilation at places where dust is formed. Read and understand the manufacturer's instruction and the precautionary label on the product. See American National Standard Z49.1, "Safety In Welding, Cutting and Allied Processes" published by the American Welding Society, <http://pubs.aws.org> and OSHA Publication 2206 (29CFR1910), U.S. Government Printing Office, www.gpo.gov.

7.2 Conditions for safe storage, including any incompatibilities

Store in closed original container in a dry place. Store away from incompatible materials. Store in accordance with local/regional/national regulations.

7.3 Specific end use(s)

For welding consumables and related products

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Section 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

Chemical Identity (CAS-No.)	ACGIH TLV (TWA)	OSHA PEL (TWA)	NIOSH REL	NIOSH STEL
Chromium (7440-47-3)	0.5 mg/m ³ [metal compound as Cr] 0.05 mg/m ³ [Cr(VI) inorganic compounds as Cr, water soluble] 0.01 mg/m ³ [Cr(VI) inorganic compounds as Cr, water insoluble]	1.0 mg/m ³ [metal compound as Cr] 0.005 mg(5 µg)/m ³ [Cr(VI) inorganic compounds as Cr(VI), water soluble] 0.005 mg(5 µg)/m ³ [Cr(VI) inorganic compounds as Cr(VI), insoluble]	0.5 mg/m ³	N/A
Iron (7439-89-6)	5.0 mg/m ³ (as Fe ₂ O ₃) respirable fraction	10.0 mg/m ³ (fume, as Fe ₂ O ₃)	5.0 mg/m ³ (dust & fume as Fe)	N/A
Manganese (7439-96-5)	0.02 mg/m ³ (elemental and inorganic compounds, as Mn – respirable fraction) 0.1 mg/m ³ (elemental and inorganic compounds, as Mn – inhalable fraction)	5.0 mg/m ³ (fume, as Mn) Ceiling	1 mg/m ³	3 mg/m ³
Molybdenum (7439-98-7)	0.5 mg/m ³ (respirable fraction, as Mo) 10.0 mg/m ³ (inhalable fraction, as Mo)	5.0 mg/m ³ (total dust, as Mo)	N/A	N/A
Nickel (7440-02-0)	1.5 mg/m ³ as metal (inhalable fraction) 0.2 mg/m ³	1.0 mg/m ³ (metal and insoluble compounds as Ni)	0.015 mg/m ³	N/A
Silicon (7440-21-3)	Withdrawn	15.0 mg/m ³ (total dust) 5.0 mg/m ³ (respirable fraction)	5.0 mg/m ³ (respirable) 10.0 mg/m ³ (total)	N/A
Titanium (7440-32-6)	10.0 mg/m ³	N/A	N/A	N/A
Barium carbonate (513-77-9)	0.5 mg/m ³ (as Ba)	2.5 mg/m ³ (as Ba)	N/A	N/A
Calcium carbonate, (Limestone) (1317-65-3)	10.0 mg/m ³	5.0 mg/m ³ (respirable fraction) 15.0 mg/m ³ (total dust)	5.0 mg/m ³ (respirable) 10.0 mg/m ³ (total)	N/A
Calcium fluoride (7789-75-5)	2.5 mg/m ³ (as F)	2.5 mg/m ³ (as F) 2.5 mg/m ³ (as F) (dust)	N/A	N/A
Cellulose (9004-34-6)	10.0 mg/m ³	5.0 mg/m ³	N/A	N/A
Feldspar (68476-25-5)	2.0 mg/m ³	10.0 mg/m ³	N/A	N/A
Graphite (7782-42-5)	2.0 mg/m ³ (all forms except graphite fibers)	5.0 mg/m ³ (synthetic) 15.0 mppcf (millions of particles per cubic foot of air)	N/A	N/A
Kaolin (1332-58-7)	2.0 mg/m ³ (respirable fraction)	5.0 mg/m ³ 15.0 mg/m ³ (total dust)	5.0 mg/m ³ (respirable) 10.0 mg/m ³ (total)	N/A
Lithium aluminum silicate (12068-40-5)	2.0 mg/m ³ (as Al fume)	None Established	N/A	N/A
Potassium silicate (1312-76-1)	10.0 mg/m ³	None Established	N/A	N/A
Silica (quartz) (14808-60-7)	0.025 mg/m ³ (respirable fraction)	2.4 mppcf (millions of particles per cubic foot of air) [respirable] 0.1 mg/m ³ 0.3 mg/m ³ (total dust)	0.05 mg/m ³ (respirable dust)	N/A
Sodium silicate (1344-09-8)	10.0 mg/m ³	N/A	N/A	N/A
Titanium dioxide (13463-67-7)	10.0 mg/m ³	15.0 mg/m ³ (total dust)	N/A	N/A

8.2 Exposure controls

General information:

Exposure Guidelines: Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) are values published by the American Conference of Government Industrial Hygienists (ACGIH). ACGIH Statement of Positions Regarding the TLVs® and BEIs® states that the TLV-TWA should be used as a guide in the control of health hazards and should not be used to indicate a fine line between safe and dangerous exposures. See Section 10 for information on potential fume constituents of health interest. Threshold Limit Values are figures published by the American Conference of Government Industrial Hygienists.

Appropriate Engineering Controls:

Use enough ventilation, local exhaust at the arc, or both to keep the fumes and gases from the worker's breathing zone & the general area. Maintain exposures below acceptable exposure levels (see Section 8.1). Use industrial hygiene air monitoring to ensure that your use of these products does not create exposures that exceed the recommended exposure limits. Always use exhaust ventilation in user operations such as high temperature cutting, grinding, welding and brazing. Train the welder to keep his head out of the fume plume. Confined spaces require adequate ventilation and/or air supplied respirators. Read and understand the manufacturer's instructions and the precautionary label on the product. See American National Standard Z49.1, Safety in Welding, Cutting, and Allied Processes, published by the American Welding Society, 8669 Doral Blvd. Suite 130, Doral, FL 33166 and OSHA Publication 2206 (29CFR1910), US Government Printing Office, Washington, D.C. 20402 for more details on many of the following.

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8.2 Exposure controls (continued)

- Eye/face protection:** Wear helmet or use face shield with filter lens shade number 12 or darker for open arc processes. No specific lens shade recommendation for submerged arc processes. Shield others by providing screens and flash goggles.
- Skin/Hand Protection:** Wear protective gloves. Suitable gloves can be recommended by the glove supplier.
- Protective Clothing:** Wear hand, head, and body protection which help to prevent injury from radiation, sparks and electrical shock. See Z49.1. At a minimum this includes welder's gloves and a protective face shield, and may include arm protectors, aprons, hats, shoulder protection, as well as dark substantial clothing. Wear dry gloves free of holes or split seams. Train the welder not to permit electrically live parts or electrodes to contact skin . . . or clothing or gloves if they are wet. Insulate yourself from the work piece and ground using dry plywood, rubber mats or other dry insulation.
- Respiratory Protection:** Keep your head out of fumes. Use enough ventilation and local exhaust to keep fumes and gases from your breathing zone and the general area. An approved respirator should be used unless exposure assessments are below applicable exposure limits. Use respirable fume respirator or air supplied respirator when welding in confined space or where local exhaust or ventilation does not keep exposure below TLV's (see Section 8.1). Use only NIOSH approved respirators in accordance with 29 CFR 1910.134 – Respiratory Protection. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).
- Hygiene measures:** Do not eat, drink or smoke when using the product. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Cosmetics should not be applied in areas where exposures exist! Routinely wash work clothing and protective equipment to remove contaminants.
- Determine the composition and quantity of fumes and gases to which workers are exposed by taking an air sample from inside the welder's helmet if worn or in the worker's breathing zone. Improve ventilation if exposures are not below limits. See ANSI/AWS F1.1, F1.2, F1.3 and F1.5, available from the American Welding Society, www.aws.org.

Section 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Solid steel rod covered with an extruded flux
Physical state	Solid
Form	Solid
Color	Metallic
Odor	No data available
Odor threshold	No data available
pH	Not applicable
Melting point/freezing point	No data available
Flammability (solid, gas)	No data available
Flash Point	Not applicable
Evaporation rate	Not applicable
Initial boiling point and boiling range	No data available

Flammability limit - upper (%)	No data available
Flammability limit - lower (%)	No data available
Explosive limit - upper (%)	No data available
Explosive limit - lower (%)	No data available
Vapor pressure	Not applicable
Vapor density	Not applicable
Relative density	No data available
Solubility in water	No data available
Solubility (other)	No data available
Partition coefficient (n-octanol/water)	No data available
Auto-ignition temperature	No data available
Decomposition temperature	No data available
Viscosity	Not applicable

Section 10 – STABILITY AND REACTIVITY

10.1 Reactivity

This product is non-reactive under normal conditions of use, storage and transport.

10.2 Chemical stability

This product is stable under normal conditions.

10.3 Possibility of hazardous reactions

Will not occur.

10.4 Conditions to avoid

Uncontrolled exposure to extreme temperatures and incompatible materials.

10.5 Incompatible materials

Strong acids, strong oxidizers, strong bases, mineral acids, some halogenated compounds, phosphorus and mercury.

10.6 Hazardous decomposition products

Welding/brazing fumes and gases can't be classified simply. The composition and quantity of both are dependent upon the metal being welded/brazed and the rods used. Coatings on the metal being welded/brazed (such as paint, plating, or galvanizing), the number of welders, the volume of the work area, the quality and the amount of ventilation, the position of the welder's head with respect to the gas plume, the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities), the process and procedures, as well as the welding/brazing consumables.

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When these steel covered electrodes are consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 3. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the materials shown in Section 3, plus those from the base metal, coatings, etc., as noted above. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from an arc, in addition to the shielding gases like argon and helium, whenever they are employed. Reasonably expected fume constituents of these steel covered electrodes would include: Complex oxides of iron, manganese, calcium, silicon, chromium, nickel, molybdenum, carbon dioxide, carbon monoxide, ozone and nitrogen oxides. Fluorides will also be present. The fume limit for chromium, nickel, calcium fluoride, silica (quartz) and/or manganese may be reached before the general welding fume limit of 5 mg/m³ is reached. One recommended way to determine the composition and quantity of fumes and gases to which workers are exposed is to take an air sample inside the welder's helmet if worn or in the worker's breathing zone. See ANSI/AWS F1.1 "Method for Sampling Airborne Particles Generated by Welding and Allied Processes" and "Characterization of Arc Welding Fume" available from the American Welding Society, 8669 Doral Blvd. Suite 130, Doral, FL 33166

A SIGNIFICANT AMOUNT OF THE CHROMIUM IN THE FUMES CAN BE HEXAVALENT CHROMIUM , ALSO KNOWN AS Cr(VI), WHICH HAS A VERY LOW EXPOSURE LIMIT OF 0.005 mg/m³ (5 µg/m³).

Monitor fume levels and Cr(VI) level. Train workers about the hazards of Cr(VI). **Read and comply with OSHA's permissible exposure limits for hexavalent chromium Cr(VI), Fed. Reg. 71 – 10099 (specifically 29 CFR 1910.1026, 29 CFR 1915.1026, and 29 CFR 1926.1126).** For Cr(VI), OSHA requires: "The employer shall perform initial monitoring to determine the 8-hour TWA exposure for each employee on the basis of a sufficient number of personal breathing zone air samples to accurately characterize full shift exposure on each shift, for each job classification, in each work area". Specialized equipment is required for monitoring Cr(VI) concentration in the workplace. OSHA Analytical Method Number ID-215 for area and breathing zone sampling and OSHA Analytical Method Number W4001 for wipe samples are listed on the OSHA website – www.osha.gov – as methods for measuring Cr(VI). This standard is complex and the employer should contact an occupational health professional for doing the Cr(VI) monitoring and all other fume monitoring.

EU RoHS (European Union Restriction of Hazardous Substances): Some of these steel covered electrodes contain Chromium. During welding these alloys will produce Cr(VI) (hexavalent chromium), however, the weld deposit does not contain Cr(VI) as it will all be in the zero valent state or as Cr(III) as an oxide. **FINISHED PRODUCTS MANUFACTURED USING THESE STEEL COVERED ELECTRODES WILL NOT CONTAIN ANY Cr(VI).**

Section 11 – TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

- Ingestion:** Health injuries from ingestion are not known or expected under normal use.
- Inhalation:** Potential chronic health hazards related to the use of welding consumables are most applicable to the inhalation route of exposure. Refer to Inhalation statements in this section.
- Skin Contact:** Arc rays can burn skin. Skin cancer has been reported.
- Eye contact:** Arc rays can injure eyes.

Symptoms related to the physical, chemical and toxicological characteristics

- Inhalation:** Short-term (acute) overexposure to welding fumes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to welding fumes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects. Respiratory exposure to the crystalline silica (quartz) present in these welding electrodes is not anticipated during normal use. Respiratory overexposure to airborne crystalline silica is known to cause silicosis, a form of disabling pulmonary fibrosis which can be progressive and may lead to death. Crystalline silica is on the IARC and NTP lists as posing a cancer risk to humans.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure): Harmful if swallowed

Specified substance: HEXAVALENT CHROMIUM LD50 (oral, rat) = 52 mg/kg LC50 (inhalation, rat) = 167 mg/m ³ /4 hr LD50 (dermal, rabbit) = 57 mg/kg	Specified substance: SILICON ATE (oral) = 3160.0 mg/kg LD50 (oral, rat) = 3160 mg/kg LC50 (inhalation, rat) > 2.08 mg/l (highest attainable concentration)	Specified substance: MOLYBDENUM LD50 (oral, rat) = 4461 mg/kg LC50 (inhalation, rat) = 5.1 mg/l/4 hr LD50 (dermal, rabbit) > 2000 mg/kg
Specified substance: NICKEL LD50 (oral, rat) > 9000 mg/kg LC50 (inhalation, rat) > 10.2 mg/l/1 hr	Specified substance: TITANIUM DIOXIDE LD50 (oral, rat) >10000 mg/kg LC50 (inhalation, rat) > 6.82 mg/l/4 hr	Specified substance: IRON LD50 (oral, rat) = 98.6 g/kg ATE (oral) = 984.00 mg/kg
Specified substance: CALCIUM FLUORIDE LD50 (oral, rat) = 4250 mg/kg LC50 (inhalation, rat) > 5070 mg/m ³ /4 hr	Specified substance: POTASSIUM SILICATE LD50 (oral, rat) = 1300 mg/kg ATE (oral) = 1300.00 mg/kg bodyweight	Specified substance: SODIUM SILICATE LD50 (oral, rat) = 1153 mg/kg ATE (oral) = 1153.00 mg/kg
Specified substance: MANGANESE LD50 (oral, rat) = 9000 mg/kg ATE (oral) = 9000000.0 mg/kg LC50 (inhalation, rat) > 5.14 mg/l/4 hr	Specified substance: CALCIUM CARBONATE LD50 (oral, rat) > 2000 mg/kg LC50 (inhalation, rat) > 3 mg/l/4 hr LD50 (dermal, rat) > 2000 mg/kg	Specified substance: SILICA, CRYSTALLINE LD50 (oral, rat) = 500 mg/kg ATE (oral) = 500.00 mg/kg

- Repeated dose toxicity (product):** Not classified
- Skin corrosion/irritation (product):** Not classified
- Serious eye damage/irritation (product):** Not classified
- Respiratory or skin sensitization (product):** May cause an allergic skin reaction
- Germ cell mutagenicity (product):** Not classified

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Carcinogenicity (product): May cause cancer

Titanium dioxide (13463-67-7)	
International Agency for Research on Cancer (IARC) Monographs	2B (Possibly carcinogenic to humans)
Silica (quartz) (14808-60-7)	
International Agency for Research on Cancer (IARC) Monographs	1 (Carcinogenic to humans)
National Toxicology Program (NTP) Status	Known to be Human Carcinogen
Nickel (7440-02-0)	
International Agency for Research on Cancer (IARC) Monographs	2B (Possibly carcinogenic to humans)
National Toxicology Program (NTP) Status	Reasonably anticipated to be a Human Carcinogen

Reproductive toxicity (product): Not classified
Specific target organ toxicity - single exposure (product): Not classified
Specific target organ toxicity - repeated exposure (product): Causes damage to organs through prolonged or repeated exposure
Aspiration hazard (product): Not classified

Other Effects: Organic polymers may be used in the manufacture of various welding consumables. Overexposure to their decomposition byproducts may result in a condition known as polymer fume fever. Polymer fume fever usually occurs within 4 to 8 hours of exposure with the presentation of flu like symptoms, including mild pulmonary irritation with or without an increase in body temperature. Signs of exposure can include an increase in white blood cell count. Resolution of symptoms typically occurs quickly, usually not lasting longer than 48 hours.

Symptoms related to the physical, chemical and toxicological characteristics under the condition of use:

<p>Specified substance: CHROMIUM (VI) Inhalation: Chromates may cause ulceration, perforation of the nasal septum, and severe irritation of the bronchial tubes and lungs. Liver damage and allergic reactions, including skin rash, have been reported. Asthma has been reported in some sensitized individuals. Skin contact may result in irritation, ulceration, sensitization, and contact dermatitis. Chromates contain the hexavalent form of chromium [Chromium (VI)]. Hexavalent chromium and its compounds are on the IARC and NTP lists as posing a cancer risk to humans.</p>	<p>Specified substance: MANGANESE Inhalation: Overexposure to manganese fumes may affect the brain and central nervous system, resulting in poor coordination, difficulty speaking, and arm or leg tremors. This condition can be irreversible. Specified substance: NICKEL Inhalation: Nickel and its compounds are on the IARC and NTP lists as posing respiratory cancer risk, and are skin sensitizers with symptoms ranging from slight itch to severe dermatitis.</p>
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Additional toxicological information under the conditions of use:

Acute toxicity

<p>Specified substance: CHROMIUM (VI) LD50 (oral, rat) = 27 – 59 mg/kg LC50 (inhalation, rat) = 33 – 70 mg/m³/4h Specified substance: FLUORIDES (as F) LD50 (oral, rat) = 4,250 mg/kg</p>	<p>Specified substance: CARBON DIOXIDE LCLo (inhalation, human) = 90000 ppm/5 min. Specified substance: CARBON MONOXIDE LC50 (inhalation, rat) = 1300 mg/l /4h</p>	<p>Specified substance: NITROGEN DIOXIDE LC50 (inhalation, rat) = 88 ppm/4h Specified substance: OZONE LCLo (inhalation, human) = 50 ppm/30 min.</p>
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Carcinogenicity:

Specified substance: Chromium (VI) or Hexavalent Chromium	
International Agency for Research on Cancer (IARC) Monographs	1 (Carcinogenic to humans)
National Toxicology Program (NTP) Status	Known to be human carcinogen
US OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)	Cancer
Specified substance: Chromium Oxide	
International Agency for Research on Cancer (IARC) Monographs	3 (Not classifiable as to its carcinogenicity to humans)
Specified substance: Nickel	
International Agency for Research on Cancer (IARC) Monographs	2B (Possibly carcinogenic to humans)
National Toxicology Program (NTP) Status	Reasonably anticipated to be a Human Carcinogen

Section 12 – ECOLOGICAL INFORMATION

Ecotoxicity

Acute hazards to the aquatic environment:

Fish

<p>Specified substance: SODIUM SILICATE LC50 (Western mosquitofish (Gambusia affinis), 96 h): 1,800 mg/l LC50 (Lepomis macrochirus), 96 h): 301 - 478 mg/l LC50 (Brachydanio rerio) [semi-static], 96 h): 3185 mg/l</p>	<p>Specified substance: NICKEL LC50 (Fathead minnow (Pimephales promelas), 96 h): 2.916 mg/l LC50 (Brachydanio rerio), 96 h): >100 mg/l LC50 (Cyprinus carpio) [semi-static], 96 h): 1.3 mg/l</p>
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SAFETY DATA SHEET



Acute hazards to the aquatic environment:

Fish (continued)

Specified substance: POTASSIUM SILICATE LC50 (Brachydanio rerio) [semi-static], 96 h): 3185 mg/l LC50 (Lepomis macrochirus), 96 h): 301 - 478 mg/l	Specified substance: IRON and/or iron alloys (as Fe) LC50 (Cyprinus carpio) [semi-static], 96 h): 0.56 mg/l
Specified substance: CALCIUM CARBONATE LC50 (Rainbow trout (Oncorhynchus mykiss), 96 h): > 100/kg	Specified substance: MOLYBDENUM LC50 (Rainbow trout (Oncorhynchus mykiss), 96 h): 800 mg/l

Aquatic Invertebrates

Specified substance: CALCIUM CARBONATE EC50 (Water flea (Daphnia magna), 48 h): > 100/kg	Specified substance: NICKEL EC50 (Water flea (Daphnia magna), 48 h): 1 mg/l EC50 (Pseudokirchneriella subcapitata), 72 h): 0.18 mg/l EC50 (Pseudokirchneriella subcapitata) [static], 96 h): 0.174 – 0.311 mg/l EC50 (Daphnia magna), 48 h): >100 mg/l
Specified substance: SODIUM SILICATE EC50 (Water flea (Ceriodaphnia dubia), 48 h): 22.94 – 49.01 mg/l	Specified substance: MANGANESE EC50 (Water flea (Daphnia magna), 48 h): 40 mg/l

Chronic hazards to the aquatic environment:

- Fish (product):** Not classified
- Aquatic Invertebrates (product):** Not classified
- Toxicity to Aquatic Plants (product):** Not classified

Persistence and Degradability

- Biodegradation (product):** No data available

Bioaccumulative Potential

- Bioconcentration Factor (BCF) (product):** No data available

Specified substance: NICKEL
 Zebra mussel (Dreissena polymorpha), Bioconcentration Factor (BCF): 5,000 - 10,000 (Lotic) Bioconcentration factor calculated using dry weight tissue conc

Mobility in Soil: No data available

Other Adverse Effects: Very toxic to aquatic organisms

Section 13 – DISPOSAL CONSIDERATIONS

Waste disposal recommendations: Prevent waste from contaminating surrounding environment. Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with international/federal/state/local regulations. However, alloy wastes are normally collected to recover metal values.

Section 14 – TRANSPORT INFORMATION

In accordance with DOT / ADR / RID / ADNR / IMDG / ICAO / IATA

14.1 UN number

Not a dangerous good in sense of transport regulations

14.2 UN proper shipping name

Not applicable

Section 15 – REGULATORY INFORMATION

15.1 US Federal regulations

Chromium (7440-47-3)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
 Listed on SARA Section 313 (Specific toxic chemical listings)
 SARA Section 313 - Emission Reporting: **1.0 %**

Nickel (7440-02-0)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
 Listed on SARA Section 313 (Specific toxic chemical listings)
 SARA Section 313 - Emission Reporting: **0.1 %**

Manganese (7439-96-5)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
 Listed on SARA Section 313 (Specific toxic chemical listings)
 SARA Section 313 - Emission Reporting: **1.0 %**

SAFETY DATA SHEET



15.1 US Federal regulations (continued)

Molybdenum (7439-98-7) Listed on the United States TSCA (Toxic Substances Control Act) inventory	Silicon (7440-21-3) Listed on the United States TSCA (Toxic Substances Control Act) inventory
Calcium fluoride (CaF₂) (7789-75-5) Listed on the United States TSCA (Toxic Substances Control Act) inventory	Titanium dioxide (13463-67-7) Listed on the United States TSCA (Toxic Substances Control Act) inventory
Potassium silicate (1312-76-1) Listed on the United States TSCA (Toxic Substances Control Act) inventory	Sodium silicate (1344-09-8) Listed on the United States TSCA (Toxic Substances Control Act) inventory
Silica, crystalline (14808-60-7) Listed on the United States TSCA (Toxic Substances Control Act) inventory	Calcium carbonate (Limestone) (1317-65-3) Listed on the United States TSCA (Toxic Substances Control Act) inventory
Iron (7439-89-6) Listed on the United States TSCA (Toxic Substances Control Act) inventory	Graphite (7782-42-5) Listed on the United States TSCA (Toxic Substances Control Act) inventory
Titanium (7440-32-6) Listed on the United States TSCA (Toxic Substances Control Act) inventory	

15.2 US State regulations

Nickel (7440-02-0)				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
Yes				
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List		U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
Titanium dioxide (13463-67-7)				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
Yes				
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List		U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
Silica, crystalline (14808-60-7)				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
Yes				
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List		U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
Chromium (7440-47-3)		Manganese (7439-96-5)		
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
Silicon (7440-21-3)		Molybdenum (7439-98-7)		
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
Calcium carbonate (Limestone) (1317-65-3)		Graphite (7782-42-5)		
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
Titanium (7440-32-6)				
U.S. - New Jersey - Right to Know Hazardous Substance List				

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CROWN ALLOYS COMPANY

Section 16 – OTHER INFORMATION

SUPERSEDES LAST REVISION: 08/10/2010 (MSDS)

HMIS RATING (Hazardous Materials Information System)			
Health (blue) - 2	Flammability (red) - 0	Reactivity (yellow) - 0	Protective Equipment - X (See Sections 4, 8 & 10)

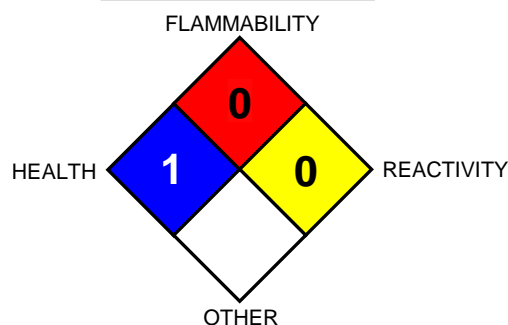
Health Hazard: 0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; one time overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal).

Flammability Hazard: 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]).

Reactivity Hazard: 0 (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures).

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDS's under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used only in conjunction with a fully implemented HMIS® program by workers who have received appropriate HMIS® training. HMIS® is a registered trade and service mark of the NPCA.

NFPA RATING



NATIONAL FIRE PROTECTION ASSOCIATION:

Health Hazard: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure cause serious temporary or residual injury); 4 (materials that under very short exposure causes death or major residual injury).

Flammability Hazard: Refer to definitions for "HMIS RATING (Hazardous Materials Information System)"

Reactivity Hazard: Refer to definitions for "HMIS RATING (Hazardous Materials Information System)"

DEFINITIONS OF TERMS

- ACGIH - American Conference of Governmental Industrial Hygienists
- CAS No. - Chemical Abstracts Service Number
- EPA - Environmental Protection Agency
- GHS - Globally Harmonized System
- IARC - International Agency for Research on Cancer
- LC50 - Lethal Concentration (50 percent kill)
- LCLO - Lowest published lethal concentration
- LD50 - Lethal dose (50 percent kill)
- LDLO - Lowest published lethal dose
- NIOSH - National Institute of Occupational Safety and Health

- NTP - National Toxicology Program
- OSHA - U.S. Occupational Safety and Health Administration
- PEL - Permissible Exposure Limit
- SARA - Superfund Amendments and Reauthorization Act
- STEL - Short Term Exposure Limit
- TCLo - the lowest concentration to cause a symptom
- TDLo - the lowest dose to cause a symptom
- TLV - Threshold Limit Value
- TSCA - Toxic Substances Control Act
- TWA - Time Weighted Average

Full text of H-phrases (from Section 2)

Acute Tox. 4 (Oral)	Acute toxicity (oral), Category 4
Aquatic Acute 1	Hazardous to the aquatic environment — Acute Hazard, Category 1
Aquatic Chronic 2	Hazardous to the aquatic environment — Chronic Hazard, Category 2
Aquatic Chronic 3	Hazardous to the aquatic environment — Chronic Hazard, Category 3
Carc. 1A	Carcinogenicity, Category 1A
Carc. 1B	Carcinogenicity, Category 1B
Carc. 2	Carcinogenicity, Category 2
Skin Irrit. 2	Skin corrosion/irritation, Category 2
Skin Sens. 1	Sensitisation — Skin, Category 1
STOT RE 1	Specific target organ toxicity — Repeated exposure, Category 1
STOT SE 3	May cause respiratory irritation
STOT SE 3	May cause drowsiness or dizziness
H302	Harmful if swallowed
H315	Causes skin irritation

H317	May cause an allergic skin reaction
H319	Causes serious eye irritation
H332	Harmful if inhaled
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled
H335	May cause respiratory irritation
H336	May cause drowsiness or dizziness
H350	May cause cancer
H351	Suspected of causing cancer
H372	Causes damage to organs through prolonged or repeated exposure
H373	May cause damage to organs through prolonged or repeated exposure
H400	Very toxic to aquatic life
H411	Toxic to aquatic life with long lasting effects

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES: Crown Alloys Company urges each end user and recipient of this SDS to study it carefully. If necessary, consult an industrial hygienist or other expert to understand this information and safeguard the environment and protect workers from the potential hazards associated with the handling or use of this product. The information in this document is believed to be correct as of the date issued. However, this information is provided without any representation or warranty, expressed or implied, regarding accuracy or correctness. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons we do not assume responsibility and expressly disclaim liability of loss, damage, or expense arising from it or any way connected with the handling, storage, use, or disposal of this product. Data may be changed from time to time. Be sure to consult the latest edition of the SDS. Compliance with all applicable Federal, State, Provincial and local laws and regulations remain the responsibility of the user.