

SAFETY DATA SHEET

CEMENTED TUNGSTEN CARBIDE PRODUCT

Revision: 04 07/06/2018

1: Identification:

Product Identifier: Cemented Tungsten Carbide Product

Other means of identification: Below

Trade name / designation: *TMK, TMP, TMN, GT, GP, GK, GD, GU* all TechMet grades consisting of Tungsten Carbide with Cobalt or Nickel binders and containing one or more of Chromium, Tantalum, Titanium, Niobium and Vanadium carbides.

Chemical Family: Refractory metal carbide

Appearance: Dark grey metallic solid (*odorless*)

Recommend use: production of cemented carbide articles for manufacturing

Uses advised against: N/A

Supplier of the SDS:

Emergency Contact:

TechMet Carbides Inc.

1 (877) 872-0044

730 21st Drive S.E

(not staffed 24/7)

Hickory, NC 28602

Phone (828)624-0222

www.techmet-carbide.com

2: Hazard(s) Identification:

Classification: This chemical is considered hazardous according to 29 CFR 1910.1200

Physical:	Health:
Flammable Solid Cat 1*	Respiratory Sensitization: Cat. 1, Skin Sensitization: Cat. 1, STOT (repeated): Cat. 1 Carcinogenicity: Cat. 1B, Eye Irritant: Cat. 2A

(*Flammable Solid Cat 1 has been declared on the basis that it is impractical to calculate the potential particle size and dispersions that occur in carbide grinding operations given to favorable conditions particles of dust /mist generated as a result are classifiable as Flammable Solid)

Label Elements:



DANGER: The intended use(s) of this product such as: cutting, grinding, brazing, welding and other industrial operations that could burn or alter the solid structure of this product as provided can release hazardous metallic particles in the form(s) of: powders, dust, mist, vapors or fumes and may be flammable. The hazards below are only applicable to the industrial machining and processing operations of Cemented Tungsten Carbide

Product. Handling of this product may cause skin irritation.

Hazard Statements:	Precautionary Statements:
(H228): Flammable solid (H317): May cause an allergic skin reaction (H334): May cause allergy or asthma symptoms or breathing difficulties if inhaled (H351): Suspected of causing cancer (H372): Causes damage to organs through prolonged or repeated exposure (H413) May cause long-lasting harmful effects to aquatic life	Prevention: (P210) Keep away from heat, hot surface, sparks, open flames and other ignition sources. - No smoking. (P284) In case of inadequate ventilation wear respiratory protection. (P260) Do not breathe dust/fume/gas/mist/vapors/spray. (P280) Wear protective gloves/protective clothing/eye protection/face protection Response: (P370) In case of fire use sand, dolomite or smother ABC Type extinguisher. (P311) Call a POISON CENTER or doctor if skin rash develops or difficulty breathing occurs (P342) If experiencing respiratory symptoms move to fresh air seek medical attention immediately (P363) Wash contaminated clothing before reuse, Storage/Disposal: (P501) Dispose of contents/container to secure container in accordance with local/regional/International Regulations. Product should be recycled.

Other Hazards (HNOC):

PBT/vPvB: No assessment required.

Other Adverse hazards: As is sold, this product is a manufactured article that may cause irritation or allergic reaction with contact. The physical and health hazards stated in 2.0 of this SDS are applicable to the byproducts generated from intended applications such as: grinding, cutting, welding, brazing.

Mechanical processing of cemented carbide product will generate hazardous chemicals in the forms of: powders, dust, mist, fumes, vapors and sludge.

Environmental Precautions: May be toxic to aquatic life with long lasting effects.

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3: Composition / information on ingredients

Ingredient:	Chemical Formula:	CAS#	EINECS#	Composition % by weight*	GHS Classification:
Tungsten Carbide	WC	12070-12-1	235-123-0	60 - 97	Not Classified
Cobalt	Co	7440-48-4	231-158-0	0 - 30	Flammable Solid: Cat 1 Respiratory Sensitization: Cat. 1 Skin Sensitization: Cat. 1 STOT (repeated) Inh: Cat. 1 Carcinogenicity: Cat. 1B / Eye Irritant: Cat. 2A
Nickel	Ni	7440-02-0	231-111-4	0 - 15	Flammable Solid: Cat. 2 Skin sensitization: Cat. 1 Carcinogenicity: Category 2 STOT (repeated) Inh: Cat. 1 Acute aquatic toxicity: Cat 1
Chromium Carbide	Cr ₃ C ₂	12012-35-0	234-576-1	0 - 3	Not Classified
Tantalum Carbide	Tac	12070-06-3	235-118-3	0 - 15	Not Classified
Titanium Carbide	Tic	12070-08-05		0 - 15	Not Classified
Niobium Carbide	NbC	12069-94-2	235-117-8	0 - 10	Not Classified
Vanadium Carbide	VC	12070-10-9	235-122-5	0 - 1	Flammable Solid: Cat 2 Skin Sensitization: Cat. 2 Eye Irritant: Cat. 2A STOT (repeated) Inh: Cat. 2

*Specific chemical percentage of composition is being withheld as a trade secret. (29 CFR 1910.1200 (i))

4: First-aid measures

Eye Contact: If eye irritation occurs flush with copious amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses if worn, during rinse. If irritation persists seek medical attention.

Skin Contact: If skin irritation or rash occurs remove contaminated clothing and thoroughly wash affected area with soap and water and rinse. If irritation or rash persists seek medical attention.

Inhalation: Remove person from exposure. If pulmonary symptoms such as coughing, wheezing, shortness of breath develop seek medical attention. If breathing has stopped perform resuscitation using universal procedures.

Ingestion: If swallowed rinse mouth and drink copious amounts of water. If concerned seek medical advice. Induce vomiting only if instructed by medical professional. Never give anything by mouth to an unconscious person.

Most important symptoms and effects both acute and delayed: General contact with metal powders may cause irritation to skin, eyes and respiratory tract. Chronic inhalation or ingestion has the potential to cause permanent disease or death and should be avoided. If person exhibits skin allergies the individual may have a sensitivity to metals and should consult physician and limit exposure.

Indications of any immediate medical attention and special treatment if needed: Unknown

Note to physicians: treat symptomatically and use general supportive care.

5: Fire-fighting measures

Extinguishing Media: For localized powder fires use dry sand, dry dolomite, sodium chloride or soda ash, ABC Type extinguisher to smother fire with inert material. Avoid use of water if water reactive metal powder may be nearby.

Special or Unusual Fire and Explosion hazards: Generally solid cemented carbide product is not a fire hazard however, under rare specific conditions where dust particles have accumulated or particles mix with oils in a mist form are exposed to high temperatures or ignition sources fire and explosion can occur. When heated to decomposition the conditions may be favorable to metal oxides or fumes.

Protective equipment and special precautions for firefighters: Use self-contained breathing apparatus. Relocate containers from fire area if possible and cool sides with water.

6: Accidental release measures

Personal precautions, protective equipment and emergency procedures: Avoid contact with skin or eyes and the formation and accumulation of dust. If airborne dust is generated use approved respirator. Wear PPE equipment specified in section 8. Wash thoroughly after handling.

Other information: Use cleanup methods that avoid dust generation such as HEPA filter that prevents release within exposure limits. Use wet cleanup for remaining residue and dispose of contents in sealed containers following section 13 for disposal.

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7: Handling and storage

Precautions for safe handling: Wash hands prior to smoking or eating after handling this material. Ensure adequate ventilation, exhaust ventilation and or appropriate NOISH approved respirator if dust/mist is being generated. Use good housekeeping procedures to prevent accumulation of dust and ensure that accepted limit values are complied with.

Conditions for safe storage: Store in cool dry conditions. Keep in sealed containers when not in use and away from incompatibilities.

Incompatibilities: oxidizing agents and strong acids are to be avoided.

Specified end-use(s): Production of cemented carbide articles for machine tool, mining, drilling, wear resistance industries etc.; for professional use only.

Other precautions: Cemented carbide product is very dense and safe lifting practices, equipment and protective equipment when applicable should be observed to limit potential muscular/skeletal injury. When in certain tooled designs edges may be extremely sharp and handling without gloves is not advised. During certain machining operations tools can fragment or evacuate chips from the metal removal process which can be extremely dangerous and appropriate machine guard's and eye protection should be used. Do not shake clothing or rags or other articles that would generate dust. Dust should be removed with appropriate HEPA type vacuum or wet wiped.

8: Exposure controls / personal protection

Control parameters:

Ingredient:	CAS#	ACGIH TLV	OSHA PEL	NIOSH IDLH:
Tungsten Carbide	12070-12-1	(Insoluble as W) 8- hour TWA REL: 5mg/m ³ STEL: 10mg/m ³	(Insoluble as W) CAL/OSHA 8-hour TWA: 5 mg/m ³ STEL: 10 mg/m ³	(Insoluble as W) 10 – hour TWA REL: 10 mg/m ³
Cobalt	7440-48-4	8-hour TWA REL: 0.02 mg/m ³	8-hour TWA PEL: 0.1 mg/m ³ CAL/OSHA 8-hour TWA: 0.020 mg/m ³	10 – hour TWA REL: 0.05 mg/m ³ IDLH PPM: 20 mg/m ³
Nickel	7440-02-0	(as elemental particulates) 8-hour TWA: 1.5 mg/m ³	8-hour TWA PEL: 1 mg/m ³ CAL/OSHA 8-hour TWA: 0.5 mg/m ³ (as metal)	10-hour TWA REL: 0.015 mg/m ³ IDLH PPM: 10 mg/m ³
Chromium Carbide	12012-35-0	(as 7440-47-3) 8 hour TLV TWA: 0.5 mg/m ³ (inhalable particulate matter)	(as 7440-47-3) 8-hour TWA PEL: 1.0 mg/m ³ CAL/OSHA 8-hour TWA: 0.5 mg/m ³	(as 7440-47-3) 10-hour TWA REL: 0.5 mg/m ³ IDLH PPM: 250 mg/m ³
Tantalum Carbide	12070-06-3	8- hour TWA REL: 0.5mg/m ³	8-hour TWA PEL: 0.5 mg/m ³	Not available
Titanium Carbide	12070-08-05	8- hour TWA REL: 10.0mg/m ³	8-hour TWA PEL: 15.0 mg/m ³	Not available
Niobium Carbide	12069-94-2	Not available	Not available	Not available
Vanadium Carbide	12070-10-9	(As dust 12604-58-9) 8- hour REL: 1mg/m ³ STEL: 3mg/m ³	(As dust 12604-58-9) 8-hour TWA PEL: 1 mg/m ³ CAL/OSHA 8-hour STEL: 3 mg/m ³	(As dust 12604-58-9) 10-hour TWA REL: 1.0 mg/m ³ STEL: 3.0mg/m ³ IDLH PPM: 500 mg/m ³

Appropriate Engineering controls: Ventilation that maintains exposure levels to those permitted above. Controls should be dependent on the amount of process automation. When not available the personnel should use respirators as listed below. Provide emergency skin/ eye wash stations and access to clean-up as specified in 6.

Personal protective equipment (PPE):



Eye/Face Protection: Safety glasses with side shield are recommended.



Skin / Body Protection: Product or evacuating chips may be sharp, consider impervious gloves and other protective clothing such as aprons or coveralls to prevent or minimize skin contact with product. When heat is a factor consider thermal gloves. Nitrile or Butyl rubber gloves are always recommended when handling residue from this product. Always wash hands prior to eating or smoking.



Respiratory Protection: Where proper engineering controls are not implemented to ensure the permissible exposure limits for airborne particulates of this product a NIOSH approved respirator is needed. Reference ANSI standard practices for respiratory safety Z88.2-1969. This product is harmful and potentially fatal if significant amounts are ingested or inhaled.

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9: Physical and chemical properties.

*Some physical and chemical information is available for this product. Where data for the mixture is unavailable, end points for the individual components are listed.

Information on basic physical and chemical properties:

Property:	*Value:
Appearance	Dark Grey metallic powder.
Odor	Odorless
Odor threshold	N/A
Molecular Weight	Mixture / 183.85 g/mol (for W)
Physical state:	Solid
pH	Not available
Softening point:	Not available
Melting point/ Freezing point:	6170°F/ 3410°C (W) 1495 °C (Co) 2927 °C (VC) 1455 °C (Ni) 1890°C (Cr) 3140 °C (TiC) 3,490° C (NbC) / 3850 °C (TaC)
Specific gravity:	12.0 – 15.5 g/cc (mixture) 18.7 – 19.3 (W)
Initial boiling point/ boiling range:	10,706°F - 5900°C (W) 2927 °C (Co) 2730 °C (Ni) 3800°C (Cr) 4820°C (TiC) 4780-5470 °C (TaC)
Flash Point:	Not available
Evaporation Point:	Not available
Flammability:	Variable on powder grade; Flammable solid (Vc) Flammable solid (NbC) Flammable solid (Cr) Flammable solid (Ni) Flammable Solid (TaC)
Upper/Lower flammability or explosive limits:	Not available
Vapor pressure:	1.97x10 ⁻⁷ mm Hg at 2327°C (W) /1 hPa (1 mmHg) at 1,810 °C (Ni) 0.0000001 hPa at 994 °C (Co)
Vapor density:	Not available
Relative Density:	4.93 g/mL at 25 °C (TaC)
Solubility in water:	Insoluble / 20°C = 2.94 mg/L (Co)
Partition coefficient (n-octanol/water):	Not available
Auto Ignition temperature:	Not self-heating down to a particle FSSS size of 1.0 µm (W)
Decomposition Temperature:	> Melting point
Kinematic viscosity:	Not relevant to its physical form
Dynamic viscosity:	Not relevant to its physical form
Explosive properties:	Not available
Oxidizing properties:	Not available
Density:	12.0 g/cc – 15.5 g/cc (mixture)
Bulk density:	Not available

10: Stability and reactivity

Chemical Stability: Product is stable under normal conditions of temperature and pressure and in its solid form as sold.

Conditions to Avoid: Contact with incompatible materials and accumulation of dust

Incompatible Materials: Strong acids and oxidizers; hydrazine nitrate, acetylene, fluorine gas, hydrogen peroxide, nitric acid, ammonium nitrate, nitrogen dioxide.

Reactivity: Can produce hazardous gases when in contact of strong acids

Possibility of hazardous reactions: Should not occur under normal conditions.

Hazardous decomposition products: When heated to decomposition hazardous metal oxides and fumes could be produced.

11: Toxicological information:

Information on likely routes of exposure: Most likely routes of exposure to hazardous effects are inhalation, ingestion, or contact with skin or eyes as a result of carbide grinding processes.

Information on possible symptoms of exposure:

Eye(s): Mechanical irritation, burning, possible damage
Skin: Irritation, burning, itching, rash
Inhalation: Nose and throat irritation, coughing and wheezing, shortness of breath, headache, tremors, dizziness, fever, chills.
Ingestion: Nausea, vomiting

Information on toxicological effects:

Tungsten (W)	
Acute Toxicity:	Not Known
LD/LC50 Values:	LD50 oral rat > 2000 mg/kg, LC50 inhalation rat > 5.3 mg/L, LD50 dermal rat > 2000 mg/kg
Inhalation:	May be harmful if inhaled. May cause respiratory tract irritation
Skin irritation or corrosion:	May cause skin irritation
Eye irritation or corrosion:	May cause eye irritation
Ingestion:	May be harmful if swallowed
Sensitization:	Not Known
Germ Cell mutagenicity:	Not Known

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Carcinogenicity:	No Evidence
Reproductive Toxicity:	No Evidence
STOT single exposure:	Not Known
STOT repeated exposure:	Intratracheal instillation of tungsten metal and tungsten carbide dust in guinea pigs at 50 mg/week for 3 weeks and repeated intratracheal instillation of tungsten carbide in rats at 10 mg/kg bw found the dusts to be relatively inert. Slightly higher intratracheal doses in guinea pigs (83 mg/kg bw/week) lead to transient reactions with almost complete recover within one year. Additionally, dust-chamber exposures of animals to tungsten, tungsten oxide, and tungsten carbide at 600mg/m ³ , 1 hr/5 mons produced only minor changes
Aspiration Hazard:	Not Known
Cobalt (Co)	
Acute Toxicity:	Acute exposure to high levels of cobalt by inhalation in humans and animals results in respiratory effects, such as a significant decrease in ventilatory function, congestion, edema, and hemorrhage of the lung. Acute animal tests in rats have shown cobalt to have extreme toxicity from inhalation exposure, and moderate to high toxicity from oral exposure.
LD/LC50 Values:	Oral LD50 6171 mg/kg (rat) Inhalation LC50 > 10 mg/L 1 hr (rat)
Inhalation:	Chronic exposure to cobalt by inhalation in humans results in effects on the respiratory system, such as Respiratory irritation, wheezing, asthma, decreased lung function, pneumonia, and fibrosis.
Skin irritation or corrosion	May cause skin irritation
Eye irritation or corrosion	May cause eye irritation
Ingestion:	Gastrointestinal effects (nausea, vomiting, and diarrhea), effects on the blood, liver injury, and allergic Dermatitis have also been reported in humans from oral exposure to cobalt.
Sensitization:	May cause allergy or asthma symptoms or breathing difficulties if inhaled / May cause an allergic skin reaction
Germ Cell mutagenicity	The Registry of Toxic Effects of Chemical Substances (RTECS) contains mutation data for components in this product.
Carcinogenicity:	IARC-2B: Possibly carcinogenic to humans: limited evidence in humans in the absence of sufficient evidence in experimental animals. ACGIH A3: Animal carcinogen: Agent is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) not considered relevant to worker exposure. Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans. Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.
Reproductive Toxicity:	Animal data on soluble cobalt compounds supports adverse effects on male reproductive organs (but no relevant data is available indicating adverse effects on female reproductive parameters) which has led to the classification of several cobalt substances for impairment of fertility. There is limited rodent developmental toxicity data on cobalt compounds.
STOT single exposure:	The following clinical signs were observed in rats after a 4-hr exposure to 0.14 – 0.53 mg/L of tungsten carbide (88 or 94%) and cobalt (6 or 12%) mixtures (Health Effects Test Guidelines, OPPTS 870.1300): difficulty breathing, rapid breathing, unkempt appearance, feces few or absent, tremors, decreased activity, scabbed facial area, red discolored facial hair, red/brown material around the nose, and skin cold to touch, red vulva discharge, vocalization, and red material around the mouth. Body weights decreased after exposure and then increased through the end of the observation period. Surviving animals regained their pretest weight by the end of the 14-day observation period. At necropsy, red discoloration of the lungs was noted.
STOT repeated exposure:	Inhalation exposure can potentially lead to disease characterized, in its most typical clinical presentation, by giant-cell interstitial pneumonia that can develop into pulmonary fibrosis. A study was conducted on a tungsten carbide and cobalt mixture in a ratio of 75:25 and was administered via inhalation for 35 days followed by a 20-day post exposure period. Following inhalation exposure, an acute inflammatory reaction later replaced by focal pneumonitis and residual bronchial epithelial hyperplasia and metaplasia were observed.
Aspiration Hazard:	Not Known
Nickel (Ni)	
Acute Toxicity:	The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute toxicity data for this substance.
LD/LC50 Values:	Oral LD50 >9000 mg/kg (rat)
Inhalation:	Chronic inhalation exposure to nickel in humans also results in respiratory effects, including a type of Asthma specific to nickel, decreased lung function, and bronchitis. Notes in additional information below.
Skin irritation or corrosion	Dermatitis is the most common effect in humans from chronic dermal exposure to nickel. Cases of nickel dermatitis have been reported following occupational and non-occupational exposure, with symptoms of eczema (rash, itching) of the fingers, hands, wrists, and forearms
Eye irritation or corrosion	May cause eye irritation
Ingestion:	May be harmful if swallowed.
Sensitization:	May cause allergic skin reaction
Germ Cell mutagenicity:	The Registry of Toxic Effects of Chemical Substances (RTECS) contains mutation data for this substance
Carcinogenicity:	Suspected of causing cancer. IARC-2B: Possibly carcinogenic to humans: limited evidence in humans in the absence of sufficient evidence in experimental animals. NTP-R: Reasonably anticipated to be a carcinogen: limited evidence from studies in humans or sufficient evidence from studies in experimental animals. ACGIH A5: Not suspected as a human carcinogen: Not suspected as a human carcinogen on the basis of properly conducted epidemiologic studies in humans. Studies have sufficiently long follow-up, reliable exposure histories, sufficiently high dose, and adequate statistical power to conclude that exposure to the agent does not convey a significant risk of cancer to humans. Evidence suggesting a lack of carcinogenicity in experimental animals will be considered if it is supported by other relevant data
Reproductive Toxicity:	The Registry of Toxic Effects of Chemical Substances (RTECS) contains reproductive data for this substance.
STOT single exposure:	Not Available
STOT repeated exposure:	Causes damage to the lung, the kidneys and the liver through prolonged or repeated exposure. Route of exposure: Inhalation
Aspiration Hazard:	Not Known

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Chromium (Cr)	
Acute Toxicity:	Not Known for Cr3 compounds
LD/LC50 Values:	> 5000 mg/kg, LC50 inhalation rat > 5.41 mg/L
Inhalation:	May be harmful if inhaled. May cause respiratory tract irritation. Notes in additional information below
Skin irritation or corrosion:	May be harmful if absorbed through skin. May cause skin irritation
Eye irritation or corrosion:	May cause eye irritation
Ingestion:	May be harmful if swallowed
Sensitization:	May cause allergic skin reaction
Germ Cell mutagenicity	Not known for Cr3 compounds
Carcinogenicity:	Suspected of causing cancer. IARC-3: Not classifiable as to carcinogenicity to humans. ACGIH A4: Not classifiable as a human carcinogen: Inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals. (inhalation) EPA-A: human carcinogen: sufficient evidence from epidemiologic studies to support a causal association between exposure and cancer. (inhalation) EPA-K: Known human carcinogens. (oral) EPA-D: Not classifiable as to human carcinogenicity: inadequate human and animal evidence of carcinogenicity or no data are available. (oral) EPA-CBD: Carcinogenic potential cannot be determined.
Reproductive Toxicity:	No Evidence
STOT single exposure:	Not Available
STOT repeated exposure:	Not Available
Aspiration Hazard:	Not Known
Vanadium (V)	
Acute Toxicity:	The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute toxicity data for components in this product
LD/LC50 Values:	LD50 oral rat > 2000 mg/kg, LC50 inhalation rat > 5.05 mg/L
Inhalation:	May be harmful if inhaled. May cause respiratory tract irritation
Skin irritation or corrosion:	May cause skin irritation
Eye irritation or corrosion:	Serious Eye irritant
Ingestion:	May be harmful if swallowed
Sensitization:	Dust from Vanadium can cause serious eye irritation and damage.
Germ Cell mutagenicity:	Not Known
Carcinogenicity:	No Evidence
Reproductive Toxicity:	No Evidence
STOT single exposure:	Not Available
STOT repeated exposure:	Not Available
Aspiration Hazard:	Not Known

Additional Toxicological information: Exposure to Nickel and Chromium may cause "metal fume fever" This is a flu-like illness with symptoms of metallic taste in mouth, headache, fever and chills, aches, chest tightness and cough. Symptoms may be delayed for several hours after exposure and persist for a day or two.

Unknown Acute toxicity: ≥40% of this mixture may contain ingredients of unknown toxicity.

12: Ecological information

Notes: No Eco toxicological information on the tungsten carbide and cobalt mixture is available. Data on the individual ingredients are listed. For some of the endpoints sodium tungstate was conducted to represent tungsten carbide. Data for cobalt dichloride was used to represent cobalt metal. Nickel may be toxic to aquatic life with long lasting effects.

Eco toxicity:

Ingredient:	Tungsten (W)	Cobalt (Co)	Nickel (Ni)
Toxicity to fish:	Zebrafish 96-h LC50 >1000 mg tungsten carbide/L (OECD 203). Zebrafish 38-day flow-through early-life stage/reproduction/ (sub) lethal effects NOEC ≥9.8 mg sodium tungstate/L (approximately 5.74 mg tungsten/L) (OECD 210).	Rainbow Trout (freshwater) 96-h LC50= 1.512 mg Co/ (ATSM) Zebrafish (freshwater) EC10= 351.4 mg Co/L. Sheepshead minnow (marine) EC10= 31,802 mg Co/L. (OECD 210)	LC50 Fish 1 100 mg/l (Exposure time: 96 h - Species: Brachydanio rerio) EC50 Daphnia 1 > 100 mg/l (Exposure time: 48 h - Species: Daphnia magna) LC50 Fish 2 15.3 mg/l EC50 Daphnia 2 1 mg/l (Exposure time: 48 h - Species: Daphnia magna [Static]) LC50 - Cyprinus carpio (Carp) - 1.3 mg/l - 96 h
Toxicity to invertebrates:	Daphnia magna 48-h EC50 >1000 mg tungsten carbide/L (OECD 202). Daphnia magna 21-day NOEC based on immobilization ≥85.1 mg sodium tungstate/L (approximately 50 mg tungsten/L) (OECD 211).	Ceriodaphnia dubia (freshwater) LC50 0.61 mg cobalt/L (USEPA) Dendroaster excentricus (marine) LC50 2.32 mg cobalt/L (ASTM) Hyallela azteca (freshwater) EC10= 0.006 mg cobalt/L (OECD 211)	EC50: = 1 mg/L, 48h Static (Daphnia magna) EC50: > 100 mg/L, 48h (Daphnia magna)

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	Daphnia magna 21-day NOEC based on reproduction and growth 44.2 mg sodium tungstate/L (approximately 26 mg tungsten/L) (OECD 211).	Neanthes arenaceodentata (marine) EC10= 0.21 mg cobalt/L (ASTM)	
Toxicity to Plants and Algae:	Desmodesmus subspicatus (algae) 72-h EC50 based on growth rate >1 mg tungsten carbide/L (OECD 201). Pseudokirchneriella subcapitata (algae) 72-h EC50 based on growth rate >17.7 mg sodium tungstate/L (approximately 10.4 mg tungsten/L) (OECD 201). Pseudokirchneriella subcapitata (algae) 72-h NOEC based on growth rate 0.81 mg sodium tungstate/L (approximately 0.476 mg tungsten/L) (OECD 201).	Pseudokirchneriella subcapitata (freshwater) EC50 based on growth rate 0.144 mg dissolved cobalt/L (OECD 201). Champia parvula (marine) EC50 based on cytoscarp production 0.024 mg dissolved cobalt/L (USEPA 821). Lemna minor 7-day (freshwater) EC10 based on growth rate 0.005 mg dissolved cobalt/L (OECD 211). Champia parvula (marine) EC10 based on cytoscarp production 0.001 mg dissolved cobalt/L (USEPA 821).	EC50: 0.174 - 0.311 mg/L, 96h static (Pseudokirchneriella subcapitata) EC50: = 0.18 mg/L, 72h (Pseudokirchneriella subcapitata)

Persistence and Degradability: Not information available

Bioaccumulation Potential: Not expected to for Tungsten Carbide.

Values for Cobalt (Co): Aquatic plants: BCF: >100-5000; Aquatic invertebrates: BCF <300; Fresh water, Fish: BCF/BAF <10.

Mobility in Soil: No data on the behavior the tungsten carbide and cobalt mixture in the environment are available. However, data for sodium tungstate and tungsten metal are expected to adequately capture the range of mobility of tungsten carbide in the environment. The adsorption/desorption is highly dependent on the characteristics of the soil system in question. For example, soil sorption coefficients of tungsten metal and sodium tungstate are found to increase with decreasing pH. Additionally, soil-tungsten systems may take up to approximately 3-4 months to reach equilibrium. Soil sorption coefficients measured for sodium tungstate ranged from 16.6 to 863 L/kg. In addition, because of the low water solubility of cobalt, mobility of this metal in soil is negligible.

Additional Ecological information: Results of PBT/vPvB assessment are not applicable. ≥ 40% of this mixture may contain ingredients of an unknown hazard to aquatic environment.

13: Disposal considerations

Waste treatment methods: Cemented tungsten carbide product is a valuable metal and it is recommended that waste materials should be reclaimed and recycled.

Disposal of waste: It is the responsibility of the consumer to dispose of this product in accordance with all federal, state, or local laws or regulations regarding disposal.

RCRA: 5.0mg/L as (Cr) 7440-47-3

California Hazardous Waste: listed Cr, Co, Ni

Contaminated packaging: Do not re-use. Dispose of in accordance with all federal, state, or local laws or regulations regarding disposal.

14: Transport information

As a solid and as sold, cemented tungsten carbide products blanks are not dangerous goods. Product is an article not applicable or regulated by US-DOT per 49 CFR 171-180. When transporting in powder or dust form classifications are dependent upon particle size and hazards for flammable solids may be applicable. When transporting by water or bulk product may be considered hazardous material (dangerous goods) primarily as a marine pollutant and applicable regulations of effected Country should be consulted.

DOT: Not regulated as sold

IMDG: Not regulated as sold

IATA: Not-regulated as sold

RID: Not regulated as sold

15: Regulatory information

Inventory Status:

U.S Toxic Substances Control Act Inventory (TSCA): all ingredients are either on the inventory or exempt from listing.

Canada Domestic Substances list (DSL/NDSL): all ingredients are either on the inventory or exempt from listing.

European Inventory of Existing Chemical Substances (EINECS): all ingredients are either on the inventory or exempt from listing.

Federal Regulations (U.S):

Occupational Safety and Health Act (OSHA): Federal OSHA Hazard communication Standard 29 CFR 1910.1200.

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CEMENTED TUNGSTEN CARBIDE PRODUCT

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SARA 313: 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; Cobalt CAS# 7440-47-3 (0.1% de minimis)/ Chromium as CAS# 7440-47-3 (1.0% de minimis) Nickel CAS 7440-02-0 (.01% de minimis)

SARA 311/312 Hazard Classes: Acute Health (Yes) Chronic Health (Yes) Fire (No) Reactivity (No) Release of Pressure (No)

Comprehensive Environmental Response and Liability Act (CERLA): This material as supplied contains the following ingredients regulated as a hazard per 40 CFR 302; Nickel CAS 7440-02-0 (100 lb. Reportable Quantity)

Clean Water Act (CWA): The following ingredients are regulated pollutants pursuant to 40 CFR 122.21 and 40 CFR 122.42; Nickel CAS# 7440-02-0, Chromium CAS# 7440-47-3/ 12012-35-0.

Canada: WHMIS hazard class D2A (very toxic materials) for Cobalt, Nickel. As sold product is a manufactured article and classification or labeling is not required.



State Regulatory Information (U.S):

California Proposition 65: Listed chemicals include: Cobalt metal powder, Nickel (metallic)



WARNING: This product can expose you to chemicals including cobalt metal powder which are known to the state of California to cause cancer. www.p65warnings.ca.gov

Right to Know States (RTK):

Ingredient:	New Jersey	Pennsylvania	Massachusetts
Tungsten Carbide (12070-12-1)	Yes	NA	NA
Chromium Carbide (12012-35-0)	Yes	NA	Yes
Cobalt (7440-48-04)	Yes	Yes	Yes
Nickel (7440-02-0)	Yes	Yes	Yes
Vanadium Carbide (12070-10-9)	Yes	Yes	NA
Titanium Carbide (12070-08-05)	Yes	Yes	NA

16: Other information

Abbreviations and Acronyms used: ACHIH = American Conference of Industrial Hygienists, ASTM = American Society for Testing and Materials, ANSI = American National Standards Institute, BAF = Bioaccumulation Factors, BCF = Bio concentration Factors, C° = Celsius, cc = Cubic Centimeter, cm = Centimeter(s), CAL = California, CAN = Canada, Carc = Carcinogenicity, CAS = Chemical Abstract Service, Cat = Category, CBD = Center for Biological Diversity, CERLA = Comprehensive Environmental Response and Liability Act, CFR = Code of Federal Regulations, Co = Cobalt, Cr = Chromium, CWA = Clean Water Act, DNA = Deoxyribonucleic Acid, DNEL = Derived no Effect Level, DOT = Department of Transportation, DSL = Canadian Domestic Substance List, EC = Effective Concentration, EINECS = European Inventory of Existing Commercial chemical Substances, EPA = Environmental Protection Agency, EU = European Union, F° = Fahrenheit, FSSS= Fisher Sub Sieve Sizer, g = Gram(s), GHS = Globalized Harmonization System, h = Hour(s), HNOC = Hazards not otherwise Classified, HEPA = High Efficiency Particulate Air, hr = Hour(s), IARC = International Agency for Research on Cancer, IATA = International Air Transport Association, IDLH = Immediately Dangerous to Life or Health, IMDG = International Maritime Dangerous Goods, INH = Inhalation, kg = Kilogram(s), L = Liter(s), LC= Lethal Concentration, LD = Lethal Dose, m = Meter(s), m³ = Cubic Meter(s), mg = Milligram(s), mm = Millimeter(s), MOL = Molecule, N/A = Not Applicable, NbC = Niobium carbide, NDSL = Canada Non Dangerous Substances List, Ni = Nickell, NIOSH = National Institute for Occupational Safety and Health, NOEC = No Observed Effect Concentration, NTP = National Toxicology Program, OECD = Organization for Economic Cooperation and Development, OEL = Occupational Exposure Level, OPPTS = Office of Pollution Prevention and Toxins, OSHA = Occupational Health and Safety Administration, PBT = Persistent Bio accumulative and Toxic, PNEC = Predicted No Effect Concentration, PPE = Personal Protective Equipment, PPM = Particles Per Million, RCRA = Resource Conservation and Recovery Act, REL = Recommended Exposure Limit, Resp = Respiratory, RTECS = Registry of Toxic Effects of Chemical Substances, RID = Regulations Concerning the International Transport of Dangerous Goods by Rail, RTK = Right to Know, SARA = Superfund Amendments Reauthorizations Act, SDS = Safety Data Sheet, Sens = Sensitization, STOT = Specific Organ Toxicity, STOT RE= Specific Organ Toxicity Repeated Exposure, STEL = Short Term Exposure Limit, TaC = Tantalum Carbide, TiC = Titanium Carbide, TLV = Threshold Limit Value, TSCA = Toxic Substance Control Act, TWA = Time Weighted Average, µg = Microgram(s), µm = Micrometer(s), UN = United Nations, US = United States of America, V = Vanadium, VC = Vanadium Carbide, vPvB = Very Persistent Very Bio accumulative, W= Tungsten, WC = Tungsten Carbide, WHMIS = Workplace Hazardous Materials Information System

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END OF SAFETY DATA SHEET