SAFETY DATA SHEET
HARDMETAL BLANK

According to 29 CFR 1910.1200 Hazard Communication Standard

Internal No.: BLANK-104-2EN-US Grades: H10 & H13A Issued: 25 May 2015

1: Identification of the substance/mixture and of the company

1.1: Product identifier

Product Name	Hardmetal blank containing primarily tungsten carbide and cobalt. 3% ≤ Co < 10%

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

Identified Uses	Production of sintered hardmetal articles
Uses advised against	Not applicable

1.3: Details of the supplier of the safety data sheet

Name	Sandvik Coromant
Address	1702 Nevins Road, Fair Lawn, NJ 07410
Phone	201-794-5000
E-mail of competent person responsible for SDS	karl.almquist@sandvik.com

1.4 : Emergency telephone number

Emergency Telephone Number	Within USA and Canada: 1-800-424-9300 Outside USA and Canada: +1 703-527-3887 (collect calls accepted)
Hours of operation	24 hours per day / 7 days per week

2: Hazards Identification

As sold, solid hardmetal blanks may cause an allergic skin reaction as a result of prolonged skin contact with the product. Operations such as grinding, cutting, burning and welding of such products may release HARDMETAL IN THE FORM OF DUSTS OR FUMES, which may present further health hazards as described in this Safety Data Sheet.

To minimize the risk of an allergic skin reaction when handling solid hardmetal blanks use gloves or in another way avoid direct skin contact.
Otherwise, the information described in this Safety Data Sheet relates to only those operations that release hardmetal and its individual components, such as tungsten carbide and cobalt dusts or fumes.

2.1: Classification of the mixture

Classification according to 29 CFR 1910.1200:	Acute Tox. 2, H330 Carc. 1B, H350i STOT RE 1, H372 Repr. 2, H361f Resp. Sens. 1B, H334 Skin Sens.1, H317 Aquatic Acute 1, H400 Aquatic Chronic 2, H411

2.2: Label elements (according to 29 CFR 1910.1200)

Hazard pictogram(s):	
Signal word:	Danger
Hazard Statement(s):	Fatal if inhaled (H330)

	May cause cancer by inhalation (H350i) Causes damage to lungs through prolonged or repeated exposure by inhalation (H372) Suspected of damaging fertility (H361f) May cause allergy or asthma symptoms or breathing difficulties if inhaled (H334) May cause an allergic skin reaction (H317) Very toxic to aquatic life with long lasting effects (H410)
Precautionary statement(s):	Do not breathe dust (P260) Wear protective gloves and protective clothing. (P280) In case of inadequate ventilation wear respiratory protection (P285) Avoid release to the environment (P273) IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician (P304 + P341 + P342 + P311)If skin irritation or rash occurs: Get medical advice/attention (P333 + P313)

2.3: Other Hazards

PBT or vPvB	Tungsten carbide and cobalt are inorganic substances and therefore, the PBT and vPvB assessment is not required.

3: Composition / information on ingredients

Substance Name	EINECS Number	CAS Number	Concentration range, % by weight	Classification GHS
Tungsten Carbide	235-123-0	12070-12-1	>50% Cermets grades: 10-20%	Tungsten carbide is not classified under GHS
Cobalt, Powder (>99% <1mm). (Respirable fraction ≥0,01% w/w)	231-158-0	7440-48-4	3% ≤ cobalt concentration < 10 %	Carc. 1B, H350i Eye Irrit. 2B, H320 Repr. 2; H361f, Acute Tox. 1, H330 Acute Tox. 4, H302 Resp. Sens. 1B, H334 Skin Sens. 1, H317 Aquatic Acute 1 (M=10), H400 Aquatic Chronic 1, (M=1), H410

4: First aid measures

4.1: Description of first aid measures

Eyes	Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Inhalation	Remove to fresh air. Seek medical attention if required.
Ingestion	Rinse mouth with water and drink plenty of water afterwards. Seek medical advice if required.

Skin	Remove contaminated clothing. Immediately wash with soap and water and rinse thoroughly. Seek medical attention if required.
General advise	After first aid, get appropriate medical attention.

4.2: Most important symptoms and effects, both acute and delayed

In general, metal powders or dust may cause mechanical eye and skin irritation. Inhalation of powder or dust may cause mild respiratory tract irritation. Chronic inhalation of hardmetal powder/dust has the potential for causing transient or permanent respiratory disease, including occupational asthma and interstitial lung fibrosis. Hardmetal powders may cause an allergic skin reaction.

4.3: Indication of any immediate medical attention and special treatment needed

None known

5: Firefighting measures

5.1: Extinguishing media

Mixture is non-flammable. Extinguishing methods depend upon hazards in vicinity. Use water or dry extinguishing powders, sand, CO_2 or other inert material as extinguishing media. Do not use water if any water-reactive metal powders are nearby.

5.2: Special hazards arising from the substance or mixture

Under rare favoring conditions of particle size, dispersion, concentration, and strong ignition source, tungsten carbide and cobalt powders or dusts may present a fire or explosion hazard.

5.3: Advice for firefighters

Use a self-contained breathing apparatus and a protective suit.

6: Accidental release measures

6.1: Personal precautions, protective equipment and emergency procedures

Avoid contact with skin and eyes, and formation and accumulation of dust. Use personal protective equipment (i.e. gloves, safety goggles, dust respirator) as specified in Section 8 of this SDS. Ventilate area of spill.

6.2: Environmental precautions

Avoid release into the environment.

6.3: Methods and material for containment and cleaning up

Use clean-up methods which avoid dust generation, such as vacuuming (with filter that prevents re-suspension of dust) or wet clean-up, and fill into appropriate sealable containers. Clean remaining spills with water. Recycle or dispose of wastes according to regulations. See section 13.1 below.

6.4: Reference to other sections

See sections 8 and 13 for exposure controls and disposal considerations.

7: Handling and storage

7.1: Precautions for safe handling

Ensure adequate ventilation and, if necessary, exhaust ventilation when handling or transferring this material. Use good housekeeping procedures to prevent accumulation of dust and ensure that accepted limit values are complied with. Wear personal protective equipment when handling.

7.2: Conditions for safe storage, including any incompatibilities

Store in a tightly closed supplied container in a well ventilated area. Store under dry and cool conditions and away from incompatible materials (acids and oxidizing agents) and direct sunlight.

7.3: Specific end use(s)

Production of sintered hardmetal articles (e.g. cutting and machining tools, mining and drilling tools, wear

parts).

8: Exposure controls / personal protection

8.1 : Control parameters

Country	For tungsten and insoluble compounds, as tungsten		Cobalt	
	8-h Limit Value (mg/m^3)	Short-term Limit Value (mg/m^3)	8-h Limit Value (mg/m^3)	Short-term Limit Value (mg/m^3)
ACGIH TLV	5	-	0.02	-
Austria	5*	10*	0.1	0.4
Belgium	5	10	0.02	–
Canada (Québec)	5	10	0.02	–
Denmark	5	10	0.01	0.02
Hungary	–	–	0.1	0.4
Poland	5	–	–	–
Spain	5	10	0.02	–
Sweden	5	–	0.02*	–
Switzerland	5*	–	0.05*	–
USA - NIOSH	5	10†	0.05	–
USA – OSHA	–	–	0.1	–
United Kingdom	5	10	0.1*	–

* Inhalable aerosol; †15-minutes

DNELs and PNECs

Exposure pattern	Route	DNEL	
		Tungsten Carbide	Cobalt
Short-term-systemic effects	Dermal	Not applicable	Not derived because cobalt dermal absorption is negligible
Short-term-systemic effects	Inhalation	Not applicable	Long-term DNEL is expected to be adequately protective of acute exposure
Short-term-systemic effects	Oral	Not applicable	Not applicable
Short-term-local effects	Dermal	Not applicable	No DNEL derived, because substance is classified as skin sensitizer with no dose-response relationship available.
Short-term-local effects	Inhalation	Not applicable	Long-term DNEL is expected to be adequately protective of acute exposure
Long-term - systemic effects	Dermal	- Workers: 1.8 mg/kg bw/day (1.7 mg W/kg/day) - General Population: 0.51 mg/kg bw/day (0.48 mg W/kg/day)	Limited data exist for DNEL development
Long-term - systemic effects	Inhalation	- Workers: 6.2 mg/m^3 (5.8 mg W/m^3) - General Population: 1.8 mg/m^3 (1.7 mg W/m^3)	- Workers: 0.040 mg/m^3 - General population: 6.3 $\mu g/m^3$
Lon□-term-systemic effects	Oral	- Workers: Not applicable - General Population: 0.51 mg/kg bw/day (0.48 mg W/kg/da□)	- Workers: Not applicable - General Population: 0.0095 mg/kg bw/day

Long-term-local effects	Dermal	Not applicable	No DNEL derived, because substance is classified as skin sensitizer with no dose-response relationship available
Long-term-local effects	Inhalation	Not applicable	- Workers: 0.040 mg/m^3 - General Population: 0.0063 mg/m^3

The most relevant routes of potential exposure to workers would be the dermal and inhalation routes. The relevant routes of exposure for the general population are the oral, dermal, and inhalation routes. Based on the available acute toxicity data (oral, dermal, inhalation), tungsten carbide is not an acute toxicant. Therefore, derivation of DNEL $_{long\text{-}term}$ will be sufficient to control potential risks associated with short-term exposures. In addition, tungsten carbide was not irritating to either the eyes or skin and was not sensitizing to the skin in standard tests. Therefore, tungsten carbide does not appear to elicit local toxicity effects and deriving a DNEL for local effects is not necessary.

Cobalt is a skin sensitizer and a DNEL was not derived because no dose-response relationship was available.

PNEC	**Value**	
	Tungsten	**Cobalt**
PNEC aqua – freshwater	0.338 mg dissolved tungsten/L	0.00051mg dissolved cobalt/L
PNEC aqua - marine water	0.0338 mg dissolved tungsten/L	0.00236 mg dissolved cobalt/L
PNEC aqua – intermittent releases	0.310 mg dissolved tungsten/L	Not applicable
PNEC sediment freshwater	960 mg tungsten/kg	11,2 mg cobalt/kg dry wt 9.5 mg cobalt/kg dry wt (added Risk Approach)
PNEC sediment marine	96 mg tungsten/kg	9.5 mg cobalt/kg dry wt
PNEC soil	2.17 mg tungsten/kg dry soil	10.9 mg cobalt/kg dry soil
PNEC sewage treatment plant	9.39 mg tungsten/L	0.00037 mg cobalt/L
PNEC oral (secondary poisoning)	11 mg tungsten/kg food	Not potential for bioaccumulation

8.2: Exposure controls

Appropriate engineering controls:

Engineering controls may include local ventilation systems with dust filters depending on degree of process automation and containment (e.g. closed vs. open processes).

Individual protection measures:

Eye/face protection	Use of safety glasses as appropriate and reasonably necessary, depending on degree of process automation and containment (e.g. closed vs. open processes).
Skin protection	Use of work gloves (For hardmetal: impervious gloves. For PEG-residues: butyl rubber and nitrile rubber) and work clothes as appropriate and reasonably necessary, depending on degree of process automation and containment (e.g. closed vs. open processes).
Respiratory protection	Use of respiratory protection as appropriate (P-Series for particles, A-series for possible PEG residues) and reasonably necessary, depending on degree of process automation and containment (e.g. closed vs. open processes).

Environmental exposure controls	**FACILITY LEVEL ENVIRONMENTAL EMISSIONS/MITIGATION[1]** **Air Emission Controls** Environmental controls for air (present in >90% of the sites[2]): • Fabric or bag filters (reported most common) • Wet scrubbers (reported second most common) • Ceramic filters • Dry or semi-dry scrubbers • Electrostatic precipitation (not common) **Water Emission Controls** The 50th percentile or reported site-specific removal efficiency for nine sites. Environmental controls for water (present in >90% of the sites for metal compound production[2]): • Chemical precipitation • Sedimentation • Filtration • Electrolysis (not common) 1 Typical environmental controls are provided for illustrative purposes and should be applied as appropriate and reasonably necessary to prevent adverse effects, indicated by a risk characterization ratio (RCR) of less than one, on human health and the environment. 2 Based on input parameters derived from the Specific Emission Release Categories (spERCs) for metals (ARCHE, 2010), spERC for Manufacture and Recycling of Massive Metal and Metal Powder v.1.2.

9: Physical and chemical properties

Some physical chemical information on the tungsten carbide and cobalt mixture is available. For endpoints where data is not available on the mixture, data on the individual components is included.

9.1: Information on basic physical and chemical properties

Appearance	Black or grey powder
Odor	Odorless
Odor threshold	Not applicable as substances are odorless
pH	Not relevant due to physical form (powder)
Melting point/freezing point	2785-2920 °C (WC) 1494 °C (Co)
Initial boiling point/boiling range	6000 °C (WC) 2927 °C at 101.325 kPa (Co)
Flash point	Not relevant as the substances are inorganic
Evaporation rate	Not relevant due to physical form (powder)
Flammability	Non-Flammable
Upper/lower flammability or explosive limits	Not relevant as the substances are not flammable
Vapor pressure	Not relevant due to physical form
Vapor density	Not relevant due to physical form
Relative density	15.63 - 15.7 g/cm^3 (WC) 8.89 g/cm^3 (Co)
Solubility in water	Insoluble (WC) The water solubility of Co at 20°C = 2.94 mg/L
Partition coefficient (n-octanol/water)	Not relevant as the substances are inorganic
Auto-ignition temperature	Tungsten carbide is not a self-heating substance down to a particle FSSS size of 0.53 µm
Decomposition temperature	Greater than 2920 °C (WC melting point) 1494 °C (Co melting point)
Viscosity	Not relevant due to physical form (powder)
Explosive properties	Not explosive
Oxidizing properties	Not oxidizing

9.2: Other information

10: Stability and reactivity

10.1: Reactivity

No hazardous reactions known.

10.2: Chemical stability

Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

10.3: Possibility of hazardous reactions

None known.

10.4: Conditions to avoid

Avoid formation and accumulation of dust.

10.5: Incompatible materials

None known.

10.6: Hazardous decomposition products

PEG decomposes (100 - 250°C) into several substances, some of which are classified as reproductive toxicants (e.g. 2-methoxyethanol and 2-ethoxyethanol.)

11: Toxicological information

Some toxicological information on the tungsten carbide and cobalt mixture is available. For endpoints were data is not available on the mixture, data on the individual components is included.

11.1: Information on toxicological effects

Endpoint	Tungsten Carbide	Cobalt
Acute oral	Rat (male/female) LD_{50} reported to be >2000 mg/kg bw (OECD 401).	Rat (female) LD_{50} reported to be 550 mg/kg bw (OECD 425).
Acute inhalation	Rat (male/female) LC50 > 5.3 mg/L (OECD 403)	Fatal if inhaled. Rat (male/female) LC50 <0.05 mg/L (OECD 436)
	Studies conducted on Hardmetal (WC-Co): WC-10% Co, pegged: Rat (male/female) LC_{50} (4 hr) reported to be c. 0.8mg/L (OECD 403) WC-30% Co, waxed: Rat (male/female) LC_{50} (4 hr) reported to be <0.14 mg/L (US EPA OPPTS 870.1300). WC-10% Co, waxed: Rat (male/female) LC_{50} (4 hr) reported to be 0.4 mg/L (US EPA OPPTS 870.1300). WC-10% Co, waxed: Rat (male/female) LC_{50} (4 hr) reported to be >1 mg/L (US EPA OPPTS 870.1300). WC-6% Co, waxed: Rat (male/female) LC_{50} (4 hr) reported to be 0.75 mg/L (US EPA OPPTS 870.1300).	
Acute dermal	Rat (male/female) LD_{50} reported to be >2000 mg/kg bw (OECD 402).	Low acute toxicity: LD50 >2000 mg/kg.
Skin corrosion/irritation	In a skin irritation study conducted on rabbits (male), tungsten carbide elicited no dermal irritation (OECD 404).	Not classified: OECD TG 439: 95.1% (Non-irritant).
Eye damage/irritation	In an eye irritation study conducted on rabbits, tungsten carbide elicited no eye irritation (OECD 405).	An in vitro bovine corneal opacity and permeability study (OECD 437) on cobalt was not corrosive or severely irritating. Cobalt was irritating to the conjunctivae of

		rabbits in an acute eye irritation (OECD 405) study. Mean scores ranged between 1.33 and 2.33 with a maximum of 3; irritation was fully reversible within 7-days.
Respiratory/skin sensitization	In a Guinea pig maximization test (OECD 406), tungsten carbide did not produce evidence of skin sensitization (delayed contact hypersensitivity) in any of the test animals. No respiratory sensitization study is available for tungsten carbide.	In the guinea pig maximization test (OECD 406) the reactivity at the test sites to repeated open application was dose and time dependent. In the general population retrospective study 8.7% of patients showed a positive reaction after patch testing with men 4.9% and women 10.5%. A case report of occupational exposure to cobalt resinate verified respiratory sensitivity of a worker to cobalt resinate and cobalt stearate by bronchio-provocation-testing with each substance. The worker did not respond to bronchio-provocation after the inhalation administration of cobalt tallate. The cobalt industry-wide questionnaire showed that there is industry experience with cobalt resinates and cases of occupational asthma. Based on available information, there is no indication the frequency of occupational asthma in workers is high.
Germ cell mutagenicity	The individual components of the mixture, tungsten carbide and cobalt are not mutagenic. However, *in vitro* mammalian alkaline elution and comet assays, as well as chromosomal aberration studies on the tungsten carbide and cobalt mixture resulted in positive mutagenic potential. Limited *in vivo comet assay* studies in rats were equivocal.	
Carcinogenicity	No indication of human carcinogenicity.	Exposure Route: Inhalation. Long term animal experiment (rat) (OECD 451). Presumed to have carcinogenic potential for humans; largely based on animal evidence.
	The mixture of WC+Co is classified by IARC as *probably carcinogenic to humans* (Group 2A) based on limited evidence for human for the carcinogenicity of Co metal with WC, and inadequate evidence in humans for the carcinogenicity of Co metal without WC). The US NTP considers cobalt-tungsten carbide (powders and hardmetals) as *reasonably anticipated to be a human carcinogen* based on limited evidence of carcinogenicity from human studies and supporting evidence from studies on mechanistic of carcinogenesis. Cobalt is “known to the state of California to cause cancer.” (Proposition 65)	
Reproductive toxicity	No reproductive/developmental studies are available for tungsten carbide. However, data are available on sodium tungstate and tungsten blue oxide, which are used for read across. Tungsten carbide is not considered a reproductive toxicant based on a one-generation reproductive study (EPA OPPTS 870.3800/870.3650) on sodium tungstate that resulted in no significant effects on reproductive/developmental parameters, as well as a lack of	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.

	reproductive organ effects in male and female rats following a 28 –days inhalation exposure (OECD 412) to tungsten blue oxide.	
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 to hardmetal can potentially lead to hardmetal 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	Tungsten carbide is not an expected aspiration hazard due to physical form.	Cobalt is not an expected aspiration hazard due to physical form.

Information on likely routes of exposure

The relevant routes of exposure for the general population are the oral, dermal, and inhalation routes. The most relevant routes of potential exposure to workers would be the dermal and inhalation routes.

Symptoms related to the physical, chemical and toxicological characteristics

In general, metal powders or dust may cause mechanical eye and skin irritation. Inhalation of powder or dust may cause mild respiratory tract irritation.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Immediate effects from short term exposure: None known

Delayed effects from chronic exposure: Inhalation exposure can potentially lead to hardmetal disease characterized, in its typical clinical presentation, by giant-cell interstitial pneumonia that can develop into pulmonary fibrosis.

Interactive effects

Hardmetal toxicity is different than the individual constituents. Please refer to mutagenicity, carcinogenicity, and STOT repeated sections described above.

12: Ecological information

No ecotoxicological information on the tungsten carbide and cobalt mixture is available. Data on the individual components or read-across substances are included. For some of the endpoints read across to sodium tungstate was conducted to represent tungsten carbide; whereas data for cobalt dichloride was used to represent cobalt metal.

12.1: Toxicity

Endpoints	Tungsten Carbide	Cobalt
Toxicity to fish	Zebrafish 96-h LC_{50} >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 LC_{50}= 1.512 mg Co/ (ATSM) Zebrafish (freshwater) EC_{10}= 351.4 mg Co/L. Sheepshead minnow (marine) EC_{10}= 31,802 mg Co/L. (OECD 210)

Toxicity to invertebrates	*Daphnia magna* 48-h EC_{50} >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). *Daphnia magna* 21-day NOEC based on reproduction and growth 44.2 mg sodium tungstate/L (approximately 26 mg tungsten/L) (OECD 211).	*Ceriodaphnia dubia* (freshwater) LC_{50} 0.61 mg cobalt/L (USEPA) *Dendraster excentricus* (marine) LC_{50} 2.32 mg cobalt/L (ASTM) *Hyallela azteca* (freshwater) EC_{10}= 0.006 mg cobalt/L (OECD 211) *Neanthes arenaceodentata* (marine) EC_{10}= 0.21 mg cobalt/L (ASTM)
Toxicity to algae and plants	*Desmodesmus subspicatus* (algae) 72-h EC_{50} based on growth rate >1 mg tungsten carbide/L (OECD 201). *Pseudokirchneriella subcapitata* (algae) 72-h EC_{50} 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).	*Pseudokirchnerella subcapitata* (freshwater) EC_{50} based on growth rate 0.144 mg dissolved cobalt/L (OECD 201). *Champia parvula* (marine) EC_{50} based on cytoscarp production 0.024 mg dissolved cobalt/L (USEPA 821) *Lemna minor* 7-day (freshwater) EC_{10} based on growth rate 0.005 mg dissolved cobalt/L (OECD 211). *Champia parvula* (marine) EC_{10} based on cytoscarp production 0.001 mg dissolved cobalt/L (USEPA 821).

12.2: Persistence and degradability

Although no data were available for the tungsten carbide and cobalt mixture, degradation and persistence are not a relevant pathway for this mixture as it is inorganic.

12.3: Bioaccumulative potential

Bioaccumulation/bioconcentration of tungsten carbide is not expected to occur in aquatic or sediment species. The bioavailability of tungstate (the most common bioavailable form) from tungsten compounds is expected to be at low concentrations in the water column due to stream and river sediment adsorption and low potential for leaching from soils. Furthermore, any uptake mediated by transport proteins would be expected to be internally regulated. The absence of methylated tungsten species also supports the claim that bioaccumulation is not expected to be of concern for tungsten carbide as an inorganic metal compound.

Based on BCFs calculated from paired concentrations of tungsten in soil and worm, or soil and plant tissue, tungsten carbide exposures are not expected to result in the bioaccumulation of tungsten in terrestrial organisms.

Cobalt has low potential for bioaccumulation based on the following bioconcentration factors (BCF) and bioaccumulation factors (BCA):

Aquatic plants: BCF: >100-5000.
Aquatic invertebrates: BCF <300.
Fresh water, Fish: BCF/BAF <10.
Marine, Fish: BCF/BAF <10.

12.4: 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.

12.5: Results of PBT and vPvB assessment

Tungsten carbide and cobalt are inorganic substances, and therefore the PBT and vPvB assessment is not required.

12.6: Other adverse effects

None known

13: Disposal considerations

13.1: Waste treatment methods

FACILITY LEVEL ENVIRONMENTAL EMISSIONS/MITIGATION

Waste Management Controls

Dispose in accordance with local/regional/national/international regulations. Two options are recommended:

1. Re-use
2. Recycling or other recovery

If this product becomes waste, the waste is to be considered as hazardous waste.

Wastewater should be processed through a sewage treatment plant (STP) either on-site or off-site.

14: Transport information

As sold, solid hardmetal blanks are not Dangerous Goods. The transport classification below applies to hardmetal powder only.

14.1: UN-No.:	UN3077
14.2: UN proper shipping name:	Environmentally hazardous substance, solid, n.o.s (contains cobalt)
14.3: Transport hazard class(es):	9
14.4: Packing group:	III
14.5: Environmental hazard(s):	Marine pollutant
14.6: Special provisions:	A97, A158, A179, A197 (IATA) 274, 335 (IMDG) 274, 335, 375 (RID) 274, 335, 375 (ADR) 274, 335, 375 (ADN)
14.7: Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:	Not applicable

Note: In the USA and certain other countries, hardmetal powder and waste and by-products of hardmetal in dispersive form, when shipped by **road** or by **air** in **non-bulk** packages, are not considered Hazardous Material (Dangerous Goods) for transportation purposes when shipped domestically.

Domestic shipments of this product and by products by **water**, or, shipments of **bulk** packages are considered Hazardous Materials (Dangerous Goods) and the transportation requirements listed in section 14.1 through 14.6 are applicable. The requirements listed in section 14.1 through 14.6 are applicable to all international shipments of hardmetal powder and waste and by-products of hardmetal in dispersive form. Please consult the applicable transportation regulations of the country you are located in.

15: Regulatory information

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

National Regulations (USA):

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

Toxic Substances Control Act (TSCA):
Components of this product are listed on the TSCA inventory.

Superfund Amendments and Reauthorization Act (SARA):
Cobalt is subject to the requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986.

State Regulatory Information:
This product contains cobalt which is listed in California Proposition 65 as a known cancer-causing chemical.

15.2: Chemical safety assessment

Not applicable.

16: Other information

Full text of classifications (GHS)	Eye Irrit. 2B, H320	Eye Irritation, category 2B
	Repr. 2; H361f	Reproductive Toxicity, category 2
	Acute Tox. 1, H330	Acute Toxicity, category 1
	Acute Tox. 2, H330	Acute Toxicity, category 2
	Acute Tox. 4, H302	Acute Toxicity, category 4
	Carc. 1B, H350i	Carcinogenicity, category 1B
	STOT RE 1, H372	Specific Target Organ Toxicity – Repeated exposure, category 1
	Resp. Sens. 1B, H334	Respiratory Sensitization, category 1B
	Skin Sens.1, H317	Skin Sensitization, category 1
	Aquatic Acute 1, H400	Aquatic Toxicity (Acute), category 1
	Aquatic Chronic 1, H410	Aquatic Toxicity (Chronic), category 1
	Aquatic Chronic 2, H411	Aquatic Toxicity (Chronic), category 2
Full text of abbreviated H statements	H302	Harmful if swallowed
	H330	Fatal if inhaled
	H350i	May cause cancer by inhalation
	H372	Causes damage to lungs through prolonged or repeated exposure by inhalation
	H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled
	H317	May cause an allergic skin reaction
	H320	Causes eye irritation
	H361f	Suspected of damaging fertility
	H400	Very toxic to aquatic life
	H410	Very toxic to aquatic life with long lasting effects
	H411	Toxic to aquatic life with long lasting effects
Revision(s):	Changes in the revised Safety Data Sheet: Section1: New e-mail address Section 2: Clarification of hazards connected to solid hardmetal blanks as such and hardmetal dust/fumes. Section 2: Changed classification of hardmetal powder. Section 14: Clarification of transport classification. Minor changes SDS prepared on 25 May 2015. Prepared in accordance with 29 CFR 1910.1200.	
References:	Tungsten Carbide Chemical Safety Report. September, 2010. International Tungsten Industry Association. Cobalt Chemical Safety Report, July 2012, Cobalt Development Institute.	

Abbreviations:

ACGIH	American Conference of Industrial Hygienists
Al	Aluminum
ASTM	American Society for Testing and Materials
BAF	Bioaccumulation Factors
BCF	Bioconcentration Factors
bw	Body weight
°C	Degrees Celsius
Carc	Carcinogenicity
CAS	Chemical Abstracts Service
CEC	Cation Exchange Capacity
CFR	Code of Federal Regulations
CI	Confidence Interval
CLP	Classification, Labelling and Packaging
cm	Centimeter(s)
Co	Cobalt
CO_2	Carbon Dioxide
DNA	Deoxyribonucleic Acid
DNEL	Derived No Effect Level
e-SDS	Extended Safety Data Sheet
EC	European Commission
EC_{50}	Effect Concentration 50%
EEC	European Economic Community
EINECS	European Inventory of Existing Commercial chemical Substances
EPA	Environmental Protection Agency
EPA OPPT	Environmental Protection Agency Office of Pollution Prevention and Toxics
EU	European Union
Fe	Iron
FSSS	Fisher Sub Sieve Sizer
g	Gram(s)
h	Hour(s)
IARC	International Agency for Research on Cancer
IBC	International Bulk Chemical

IRIS	Integrated Risk Information System
kg	Kilogram(s)
L	Liter(s)
LC_{50}	Lethal Concentration 50%
LD_{50}	Lethal Dose 50%
LOAEC	Lowest Observable Adverse Effect Concentration
LOAEL	Lowest Observed Adverse Effect Level
m^3	Cubic Meter(s)
m	Meter(s)
MARPOL	International Convention for the Prevention of Pollution From Ships
mg	Milligram(s)
Mn	Manganese
MS	Member State
ng	nanogram
Ni	Nickel
NIOSH	National Institute for Occupational Safety and Health
NOAEC	No Observed Adverse Effect Concentration
NOAEL	No Observed Adverse Effect Level
NOEC	No Observed Effect Concentration
No.	Number
NTP	National Toxicology Program
OECD	Organization for Economic Co-operation and Development
OEL	Occupational Exposure Level
OSHA	Occupational Safety and Health Administration
PBT	Persistent, Bioaccumulative, and Toxic
PNEC	Predicted No Effect Concentration
RCR	Risk Characterization Ratio
REACH	Registration, Evaluation, Authorization and Restriction of Chemical substances
Resp.	Respiratory
SDS	Safety Data Sheet
Sens.	Sensitization
SMR	Standard Mortality Ratio

spERC	Specific Emission Release Categories
STOT-RE	Specific Target Organ Toxicity - Repeat
STP	Sewage Treatment Plant
TLV	Threshold Limit Value
µg	Microgram(s)
µm	Micrometer(s)
UN	United Nations
USEPA	United States Environmental Protection Agency
vPvB	very Persistent, very Bioaccumulative
W	Tungsten
WC	Tungsten carbide

Users Responsibilities

This SDS provides information consistent with recommended applications of these products and anticipated activities involving the product. It is the user's responsibility to identify and protect against health and safety hazards presented by modification of hardmetal powders and products after manufacture. Individuals handling hardmetal powders should be informed of all relevant hazards and recommended safety precautions, and should have access to the information contained in this SDS.

Disclaimer

The information contained herein is based upon data provided by manufacturers and suppliers of raw materials used in the manufacture of hardmetal powders. The information is offered in good faith as accurate and correct, but no representations, guarantees, or warranties of any kind are made as to its accuracy or completeness, suitability for particular applications, hazards connected with the use of the powder, or the results to be obtained from the use thereof. The user assumes all risk and liability of any use or handling of any material beyond Sandvik's control. Variations in methods, conditions, equipment used to store, handle, or process the material, and hazards connected with the use of the powder are solely the responsibility of the user and remain at its sole discretion.

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End of Safety Data Sheet