

April 2006

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product name: Tungsten Carbide
 Also known as: Sintered Tungsten Carbide, Cemented Tungsten Carbide, Carbide, Hard Metal, WC, Tungsten Carbide Product
 Chemical Name: Cemented Tungsten Carbide Product with Cobalt Binder
 Chemical Symbol: WC/Co
 Chemical Family: Refractory Metal Carbide
 Product Usage: Hard metal used in manufacture of durable wear parts such as drill/mill/router bits, burr tools, nozzles, rock and earth drilling parts, rock hammers, hard surfaces and linings, slitter knives, mechanical seal faces, chisel buttons, jaw grips, lead-free fishing weights, etcetera.

Suppliers Name: Stanford Advanced Materials
 Address : 23661 Birtcher Dr.,
 Lake Forest, CA 92630 U.S.A.

Emergency Telephone: (949) 407-8904
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SECTION 2: COMPOSITION - INFORMATION ON INGREDIENTS

Component	CAS #	% (by weight) *	OSHA PEL (mg/m ³)	ACGIH TLV (mg/m ³)
Tungsten Carbide (WC)	12070-12-1	80 – 97	15 **	10 **
Cobalt (Co)	7440-48-4	3 – 20	0.1	0.02

* Depends upon grade specification.

** The OSHA PEL and ACGIH TLV for the respirable fraction of total dust is 5 mg/m³.

SECTION 3: HAZARDS IDENTIFICATION

No health hazards are known to exist or have been reported from exposure to this material in its usual 'solid form', however, ***grinding a Tungsten Carbide product will produce dust and powder or a mist of potentially hazardous ingredients which may then be inhaled, swallowed, or come into contact with the skin or eyes.***

Dust from grinding can cause immediate irritation of the eyes, nose, throat, and skin. Eye, nose and throat contact via the mucous membranes causes irritation including redness, pain, and itching. Pre-existing pulmonary and skin conditions such as emphysema, asthma, bronchitis, dermatitis and eczema may be aggravated by even moderate exposure for some individuals. Acute overexposure in the form of inhalation may cause respiratory tract irritation with wheezing, shortness of breath and difficulty in breathing, and fits of coughing which may produce blood and soreness in the chest. Prolonged or chronic overexposure has the potential for causing transient or permanent respiratory disease including allergic respiratory reaction ("Occupational Asthma"), obstructed airways from build-up of dust in the lungs, and an interstitial fibrosis condition (scarring of the lung) known as "Hard Metal Lung Disease". Permanent respiratory disease can lead to disability or even death.

It is believed that the Cobalt component is the more harmful element of Cemented Tungsten Carbide Product, as is reflected in the Permissible Exposure Limits (PEL) published by the Occupational Safety and Health Administration (OSHA) and the even more conservative Threshold Limit Values (TLV) published by the American Conference of Governmental Industrial Hygienists (ACGIH) shown in section 2. Inhalation of 20 mg/m³ is immediately dangerous to life and health. [The tungsten carbide component itself is actually regulated by the OSHA as a Particulate Not Otherwise Regulated (PNOR). The exposure limits listed for both the OSHA and the ACGIH refer to total dust, of which only a portion is considered respirable.] Actual ingestion of elemental cobalt, itself a metal, may cause gastrointestinal irritation, diarrhoea, and in significant amounts has the potential for causing blood, heart and other organ problems.

Tungsten Carbide Products in their solid form also do not present a fire hazard. Dusts, however, may present a fire or explosion hazard under rare, favouring conditions of quantity, dispersion, and particle size combined with a strong ignition source. This is not expected to be a problem under normal conditions.

SECTION 4: FIRST AID MEASURES

Inhalation: If symptoms of pulmonary involvement develop (coughing, wheezing, shortness of breath) remove from exposure area to fresh air immediately. Keep the affected person warm and at rest. Seek medical attention. If breathing has stopped, perform artificial respiration and get medical attention immediately.

Eye Contact: Acute or chronic contact with the eyes will cause conjunctivitis (pink eye) owing to irritation of the thin conjunctive membrane covering the eye. If such irritation occurs, wash eyes immediately with large amounts of suitably warm and clean water (such as at an eye wash station if available), occasionally lifting the upper and lower lids until no evidence of material remains in the eye. In severe cases,

this procedure could take 15 to 20 minutes and professional medical attention should be sought in any event.

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

Ingestion: If substantial quantities are swallowed and the person is conscious, give the person large amounts of water to dilute. After water has been swallowed, induce vomiting. Vomiting may not be required if only a very small amount of the substance was ingested, but in this case a physician should be contacted for instruction. Do not attempt to make an unconscious person drink or vomit. Seek medical attention immediately.

SECTION 5: FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Only under very rare and favouring conditions where higher concentrations of finely divided powder or dust accumulate from grinding is there expected to be any fire or explosion hazard when inappropriately exposed to high temperatures or ignition sources. Particle size and dispersion in the air determine the reactivity. Cemented Tungsten Carbide Product, except in this powder or dust form, is not a fire hazard. The National Fire Protection Association (NFPA) hazard ratings for this product are: *Health – 1, Fire – 0, Reactivity - 0*

Flash Point and Method: N/A

Upper and Lower Flammable Limits in Air: None

Auto-Ignition Temperature: N/A

Hazardous Combustion Products: Acrid smoke and irritating fumes from burning powder in a conventional fire. The melting point of Cemented Tungsten Carbide itself is in the range of 3000° C and the boiling point 6000° C.

Extinguishing Media: For localized powder fires, smother the fire with dry sand, dry dolomite, sodium chloride, or soda ash. Use fire extinguishing media appropriate to fight surrounding fire such as type ABC. (If no other alternative, flood with water.)

Special Fire-Fighting Procedures: Move containers (of powder) from fire area if possible. Cool containers exposed to flame with water from side until fire is well out. Use extinguishing water stream carefully and contain runoff if possible. Fire-fighters should wear National Institute for Occupational Safety and Health (NIOSH) or similarly approved full-face, self-contained breathing apparatus (SCBA) operated in positive pressure mode and full turnout gear. For massive fires, such as in cargo areas or warehouses, use unmanned hose holders and/or monitor nozzles, or else withdraw entirely and let fire burn if large amounts of particulates are believed to be present.

SECTION 6: ACCIDENTAL RELEASE MEASURES

With respect to ground powder and dust only (the solid form is basically inert), sweep up with a minimum of airborne dust generation and place into suitable, clean, dry container for later disposal or reclamation. Residue should be cleaned up using a high-efficiency particulate air (HEPA) filter vacuum or utilize wet clean-up procedures. Use appropriate personal protective equipment (PPE) including respiratory protection for larger spills such as a NIOSH approved air-purifying (AP) filter-type respirator.

SECTION 7: HANDLING AND STORAGE

Cemented Tungsten Carbide Product can be handled and stored without much special attention at all except that one should wash one's hands thoroughly before eating, smoking, or otherwise touching one's face (ex. rubbing one's eyes) in accordance to health information provided in section 3 above. A blackish residue of fine powder does soon accumulate on the hands and skin in handling the product even though it may appear clean and therefore thin rubber or vinyl gloves or similar should be worn to keep clean, especially if handling is to take place routinely and for more than just a few minutes, as part of one's regular employment for example, and most especially if there are any cuts or other skin conditions of the hands which may be exacerbated by the contact with the residue.

Minimize free-fall of powder produced when grinding the material (grinding with special grinding wheels being the only method of shaping the very hard metal). Prevent dispersion of dust into the air at all times whether grinding or moving/cleaning up/storing the ground by-product. In addition to the health hazard of breathing any airborne particles, the dust or even fumes may be flammable or explosive, as outlined in section 5. Keep powder accumulations away from sparks, ignition sources, and any fan or device which might disperse the dust into the air. Do not shake clothing, rags, or other items to remove dust. Dust should be removed by washing or vacuuming.

SECTION 8: EXPOSURE CONTROL / PERSONAL PROTECTION

As outlined above in section 7, general cleaning habits such as keeping one's hands washed or wearing simple protective gloves are normally sufficient methods of protection when handling the solid form of cemented tungsten carbide. It is the powder form of the product (that is the by-product of grinding the cemented tungsten carbide) that presents the only real dangers.

Ventilation: If there is to be grinding of the carbide parts, provide local exhaust ventilation or general dilution to maintain exposure levels below the PEL and TEL levels outlined in section 2. As it is very difficult to know, without professional testing equipment, just how much actual dust is being created in a given work area, it is better to err on the side of caution as much as possible given the health risks involved. If a workplace is more than simply occasionally involved in the grinding of tungsten carbide products, then the appropriate testing must be carried out for the protection of all concerned which in the long run will be far less costly than the testing. There are numerous documented cases of incapacity and death resulting from lung diseases in workers

chronically overexposed to these dust forms. And if there is no or inadequate ventilation protection, then respiratory protection in some form is a must.

Respiratory Protection:

Particulate Levels (Cobalt)	Respiratory Protective Equipment
0.05 mg/m ³	Single-use approved dust and mist respirator.
0.5 mg/m ³	Dust mask, except single use respirator.
1 mg/m ³	Dust mask, except single use and quarter-mask respirator. Fume or high efficiency particulate respirator.
5 mg/m ³	High efficiency particulate respirator with full face-piece. Supplied air respirator with a full face-piece, helmet or hood. Self-contained breathing apparatus (SCBA) with full face-piece.
20 mg/ m ³	Powered air-purifying respirator with high efficiency filter with full face-piece. Type 'C' supplied-air respirator with a full face-piece operated in pressure-demand or other positive pressure mode.
Fire Fighting	SCBA with full face-piece operated in pressure-demand or other positive pressure mode.

Other Protection: As far as PPE goes, the use of gloves, special clothing or clothing washing procedures, and protective eyewear is dependant upon the amount of contact one has and with what form of the product. Protective gloves are to be worn if handling the product and especially product the powder produced from grinding as outlined in section 7. For minimal handling of the hard metal form, there is no danger and gloves are not required, but a thorough washing of the hands is recommended to avoid possible residue contact with ones eyes and mouth. Appropriate gloves and clothing are required only so that repeated or prolonged contact with the skin is avoided. Soiled clothing could be washed separately from other clothing, but unless working directly with the powder residue of grinding where one is likely to get quite covered in it, there is little need for extra attention or caution. Appropriate safety glasses are an absolute necessity if grinding the product, as is common safe practice in grinding any material, and likewise, appropriate goggles are highly recommended if one is in an area where the dust or powder is expected to be in the air in abundance, but otherwise, handling of the hard metal itself requires no more eye precaution than keeping ones hands out of them owing to possible residue transfer. Safety glasses are always a good idea if in handling any given material in one's occupation that it might get in one's eye, and contact lenses are best to be avoided when handling these materials.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Grey coloured metal solid (or powder); solid metal may appear chrome finished if surface is finely ground.

Odour: None PH: N/A Insoluble in water.

Physical State: Solid to about 3000° C (5400° F), depending on particular make-up, boiling point about 6000° C (10,800° F).

Density: Where water has a specific gravity of 1, Cemented Tungsten Carbide ranges from about 13 to 15 times that. Density is thus 13 to 15 g/cc, heavier than Lead which is about 11 g/cc.

SECTION 10: STABILITY AND REACTIVITY

Stability: Under normal conditions of standard pressure and temperature (STP), the solid metal form of Cemented Tungsten Carbide is completely stable.

Conditions to Avoid: Contact with strong acids.

Incompatibility: Contact of the dust produced in grinding of the material with certain strong oxidizers may cause fire or explosions. Dust from grinding will contain ingredients as listed in section 2, Tungsten Carbide and Cobalt, which individually can react as follows:

Tungsten Carbide:

Chlorine Trifluoride – reacts with flame

Fluorine – incandesces

Nitrogen Dioxide, Nitrous Oxide – burns with incandescence if heated

Iodine Pentafluoride, Lead Oxide – reacts violently

Cobalt:

Ammonium Nitrate + Metals or Bromine Pentafluoride – reacts violently and sometimes explosively

Hydrazinium Nitrate – decomposes explosively upon rapid heating

Nitryl Fluoride, Acetylene – reacts incandescently

Hazardous Decomposition Products:

Thermal decomposition such as may occur in an extremely hot fire may release acrid smoke and irritating fumes if in dust form.

Hazardous Polymerization: Will not occur.

SECTION 11: TOXICOLOGICAL INFORMATION

The sintered, solid form of Tungsten Carbide with Cobalt Binder is not considered to be toxic, however the individual component Cobalt, which may be separated in dust form from the solid material by grinding, is listed as a Category 2B carcinogen (possibly carcinogenic to humans). The effects of dust containing Cobalt on human health are contained in section 3.

SECTION 12: ECOLOGICAL INFORMATION

Although there is no specific eco-toxicity data available, it is not expected that this product, especially in its solid form, would be a hazard to the environment.

SECTION 13: DISPOSAL CONSIDERATIONS

Disposal of any materials must be made in accordance with local regulations and it is the responsibility of the waste generator to determine the proper waste disposal procedures to be in compliance with the given local regulations. Tungsten Carbide Product is a valuable material that should be sent to an appropriate reclamation facility if available.

SECTION 14: TRANSPORT INFORMATION

The solid form of Tungsten Carbide Product is safe and therefore its transport is *not regulated* in Canada or the United States. No Hazard Class signage or other special labelling is required.

SECTION 15: REGULATORY INFORMATION

Tungsten Carbide and Cobalt are chemical substances subject to supplier notification.

In Canada: The Canadian Workplace Hazardous Materials Information System (WHMIS) classification for Cobalt is D2B. Cemented Tungsten Carbide Product itself is not a controlled product and meets the definition of a "manufactured article" under the WHMIS regulations.

In the United States:

The ingredient Cobalt is subject to the requirements of Section 313 of Title III of Superfund Amendments and Reauthorization Act (SARA) of 1986 and 40 CFR Part 372 (Toxic Chemical Release Reporting).

Cobalt	CAS# 7440-48-7	20% maximum
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This product has been classified under the Controlled Products Regulations (CPR) and this MSDS has been prepared to meet the requirements therein.

SECTION 16: OTHER INFORMATION

End Of Material Safety Data Sheet

In case of questions, please call: (949) 407-8904
(This telephone number is available 24 hours per day, 7 days
per week.)

MSDS prepared by: Ron Brevik, B.A.Sc., Casmel Supply Limited, April 2006
Revision 0