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SAFETY DATA SHEET

1. Chemical and Manufacturer Information

1.1 Product Name

High Pressure High Temperature Synthetic Single Crystal Diamond

1.2 Company Information

Company Name : Sumitomo Electric Hardmetal Corp.
Address : 1-1-1, Koya-kita, Itami, Hyogo, 664-0016 Japan
Department : Super Hard Materials Manufacturing Department
Phone No. : +81-72-771-0555
Fax No. : +81-72-773-5152

1.3 Chemical Family : Diamond, Metal and Carbide

2. Hazards Identification

2-1. GHS classification

The impurities of the diamond and the powder/dust generated through machining have not been classified under the GHS classification because data from the combustion speed test were not available.

The hazardous and harmful properties of the elemental metal constituent of impurities in the diamond (cobalt, nickel, manganese, and aluminum) were classified as follows. Be advised that the hazardous and harmful properties and influence (harmful influence on health, the influence on environment, and hazardous physical and chemical properties) that are not described are not relevant for the categories or classifications, or classification is not possible.

- Cobalt

Hazards to Health:	• Respiratory sensitization Category 1 • Skin sensitization Category 1 • Carcinogenicity Category 2 • Particular target organ toxicity (single exposure) Category 3 (respiratory passage irritant) • Particular target organ toxicity (repetitive exposure) Category 1 (respiratory tract)
Environmental Hazards:	• Aquatic environment chronic hazardous property Category 4

- Nickel

Hazards to Health:	• Respiratory sensitization Category 1 • Skin sensitization Category 1 • Carcinogenicity Category 2 • Particular target organ toxicity (single exposure) Category 1 (respiratory tract, kidney) • Particular target organ toxicity (repetitive exposure) Category 1 (respiratory tract)
Environmental Hazards:	• Aquatic environment chronic hazardous property Category 4

- Manganese

Hazards to Health:	• Skin corrosivity/sensitization Category 3 • Critical damage to eyes/eye sensitization Category 2B • Reprotoxicity Category 1B • Particular target organ toxicity (single exposure) Category 1 (respiratory tract) • Particular target organ toxicity (repetitive exposure) Category 1 (nervous system, respiratory tract)
Environmental Hazards:	• Aquatic environment chronic hazardous property Category 4

- Aluminum

Hazards to Health:	• Particular target organ toxicity (single exposure) Category 1 (respiratory tract) • Particular target organ toxicity (repetitive exposure) Category 1 (respiratory tract)
Environmental Hazards:	• Aquatic environment chronic hazardous property Category 4

2-2. GHS label element

The GHS Label elements for the elemental metal constituent of diamond impurities (cobalt, nickel, manganese and aluminum) are as follows.

	Cobalt	Nickel	Manganese
Pictorial Indication or Symbol:			
Caution Words:	Danger		
Hazardous and Harmful Property Information:	• Risk of allergic skin reactions • Risk of allergic reaction, asthma or dyspnea • Risk of sensitization to respiratory tract • Suspect of oncogenic risk • Disorder of respiratory tract, cardiovascular system, thyroid gland, or blood system by long-term or repeated exposure • Risk of harm to aquatic organisms from long term continuous exposure	• Risk of allergic reaction, asthma or dyspnea by aspiration • Risk of allergic skin reactions • Suspect of oncogenic risk • Disorder of respiratory tract or kidneys • Disorder of respiratory tract by long-term or repeated exposure • Risk of harm to aquatic organisms from long term exposure	• Mild skin irritancy • Eye irritancy • Risk of adverse impact on reproductive competence or on the fetus • Disorder of respiratory tract • Disorder of nervous system or respiratory tract by long-term or repeated exposure • Risk of harm to aquatic organisms from long-term exposure
Precautions	[Safety Measures] • Do not handle until reading and understanding all safety precautions. • Use appropriate individual protective equipment and ventilation equipment and avoid exposure. • Wear appropriate protective gloves. • Where the ventilation is insufficient, wear appropriate protective respiratory equipment. • Avoid inhaling the powder and dust. • Do not drink, eat, or smoke in a place where the product is handled. • Wash hands well after handling		

	• Avoid discharging into the environment. [First Aid] • When inhaled, issue instructions to move to a place with fresh air and rest with a good breathing posture. • If any symptoms of aspiration appear, consult a physician. • When feeling sick, get a diagnosis/treatment by a physician. • The clothes on which the dust adheres should be washed before reusing. • Adhesion on the skin should be washed away with a quantity of water and soap. • If skin irritation occurs due to the adhesion on the skin, ask a physician for diagnosis and treatment. • In the event of exposure or possible exposure, seek immediate medical attention. • When the powder or dust gets in the eyes, immediately flush with fresh flowing water (remove contact lenses if possible). If irritation persists, seek immediate medical attention. • If a large quantity is swallowed, dilute by drinking water and seek immediate medical attention. [Storage] • Avoid abrupt changes in temperature or locations with high humidity for storage. [Disposal] • Disposal of the contents and containers should be subcontracted to a professional contractor authorized by the governor of the prefecture for waste treatment service.

	Aluminum
Pictorial Indication or Symbol:	
Cautions:	Danger
Hazardous and Harmful Property Information:	• Combustible or inflammable gas is generated by contact with water. • Disorder of respiratory tract. • Disorder of respiratory tract by long-term or repeated exposure. • Risk of harm to aquatic organisms from long-term continuous exposure.
Cautions	[Safety Measures] • Prevent contact with water. • Cutoff humidity and treat in an inert gas atmosphere. • Do not inhale the powder, dust/gas/mist/steam/spray. • Wash hands well after handling. • Do not drink, eat, or smoke when using this product. • Wear protective gloves/protective clothes/protective glasses/face protection. • Avoid discharging into the environment [First Aid] • In the event of exposure or possible exposure, seek immediate medical attention. • When feeling sick, seek immediate medical attention. • Special treatment is required. (see … on this label) • Brush off any particles not adhering to the skin and bathe in cold water or cover with wet bandages. • In case of fire: Use appropriate fire extinguishing agents. [Storage] • Store in a sealed container in a dry place. • Store under lock and key. [Disposal] • The disposal of the contents and containers should be subcontracted to a

	professional contractor authorized by the governor of the prefecture for waste treatment service.

3. Composition / Information on Ingredients

- Distinction of Single Product/Mixture: Single Product

  * Cobalt, nickel, manganese, or aluminum other than diamonds may be included as impurities.
- Diamonds and the impurity constituent and concentration or concentration range (content)

Constituent	Formula	CAS No.	PRTR Class/No.	ISHA EO#	Composition mass%
Diamond	C	7782-40-3	-	-	100
Cobalt	Co	7440-48-4	Class 1/No.132	App. Table 9-172	0 - 20
Nickel	Ni	7440-02-0	Class 1/No.308	App. Table 9-418	0 - 20
Manganese	Mn	7439-96-5	Class 1/No.311	App. Table 9-550	0 - 20
Aluminum	Al	7429-90-5	-	App. Table 9-37	0 - 5

4. Emergency and First Aid Procedures

4.1 Inhalation

- When the powder or dust is inhaled or respiratory symptoms (tussis (cough), stridor (wheezing), short breath, etc.) appear, issue instruction to move to a place with fresh air and rest in a good breathing posture. If dyspnea occurs, inhale oxygen. If respiratory distress occurs, begin rescue breathing, and seek immediate medical attention.
- If irritation or exanthema continues, seek immediate medical attention.

4.2 Skin Contact

- When the powder or dust adheres to the skin, remove the affected clothing and thoroughly wash the adhesion with a soap solution. If irritation or exanthema persists, seek immediate medical attention.

4.3 Eye Contact

- If the dust gets in the eyes, (remove contact lens if possible) immediately flush with fresh flowing water. If irritation persists, seek immediate medical attention.

4.4 Ingestion

- If a large quantity of powder or dust is swallowed, dilute with fresh water and seek immediate medical attention.

5. Fire Procedures

5.1 Fire Extinguisher

- In case of a powder or dust fire, use dry sand, exfoliated vermiculite or exfoliated perlite, ABC type powder fire extinguisher (for general, oil and electric fire), or water (water is prohibited for powder and dust containing the cut chips of light metals magnesium and aluminum) to extinguish the fire.
- For aluminum, use powder fire extinguishing agent, sodium ash, lime, and sand for a small fire; use dry sand, powder fire extinguishing agent, soda ash, or lime for a large fire.

5.2 Fire fighter's protection

- A person who carries out fire extinguishing shall wear protective clothing, dust protection mask, or respiratory protection.

6. Spill and Leak Procedures

6.1 Attention to the Human Body

Clean-up personnel should wear personal protective equipment including respiratory protection which is appropriate for the magnitude of exposure.

6.2 Attention to the Environment

Dust must be treated as an industrial waste and must not leak to the water system.

6.3 Removal Procedures

For removal of dust from the grinding and machining operation, isolate area and do not walk through else material will get scattered. Remove dust using a vacuum equipped with a filter sufficient to remove metal dust and prevent their circulation (a high efficiency particulate air (HEPA) filter is recommended). If an appropriate vacuum is unavailable, use mist , a wet dust mop or another wet clean-up method to remove the dust.

7. Handling and Storage

7.1 Handling

- Diamond is a stable substance and has almost no influence on health, but a long time or repetitive contact with powder/dust or grinding fluid that contains cobalt, nickel or manganese may cause a skin disorder.
- Where a scattering of powder/dust containing cobalt, nickel, manganese, or aluminum is possible, minimize the exposure of human body by installing a spot ventilation equipment, using the protective equipment, etc.
- Do not handle until reading and understanding all safety precautions.
- Avoid inhaling the powder/dust
- Do not drink, eat or smoke in a place where the product is handled.
- Wash hands well after handling
- Avoid discharging in the environment

7.2. Storage

- Avoid abrupt changes in temperature or a place with high humidity for storing.

8. Exposure Controls and Personal Protection

Use a dust protective mask and a respirator, and set up local exhaust ventilation to prevent airborne dust which exceeds the permissible level on the following table.

8.1 Permissible exposure limit in working environments

Constituent	Formula	OSHA* PEL* mg/m^3 (Metal Dust Concentration)	ACGIH** TLV* mg/m^3 (Metal Dust Concentration)	JSOH*** Permissible Concentration mg/m^3
Diamond	C	N/A	N/A	N/A
Cobalt	Co	0.1 (as Co)	0.02 (as Co)	0.05 (as Co)
Nickel	Ni	1.0	1.5	1.0

		(as Ni)	(as Ni)	(as Ni)
Manganese	Mn	5.0 (as Mn)	0.2 (as Mn)	0.3 (as Mn)
Aluminum	Al	15 (as Al)	1.0 (as Al)	0.7 (as Al)

*OSHA: Occupational Safety and Health Administration U.S. Department
PEL: Permissible Exposure Limit.
**ACGIH: American Conference of Governmental Industrial Hygienists Inc. TLV: Threshold Limit Value
***JSOH: Japan Society for Occupational Health
****N/A : Not Applicable

8.2 Respiratory protection

It is recommended to wear respiratory protective equipment or dust mask for protection against dust.

8.3 Hands protection

It is recommended to wear protective gloves for protection against dust.

8.4 Eye protection

It is recommended to wear protective glasses or chemical safety goggles for protection against dust.

8.5 Skin and body protection

Avoid direct contact of dust with skins.

In order to remove attached dust, do not shake off clothes or pieces of cloth, but be sure to remove dust by laundering or absorbing with a vacuum cleaner with suitable filters. Change contaminated clothes to clean clothes. It is recommended to use local exhaust ventilation system.

9. Physical and Chemical Properties

Appearance:	yellow solid substance
Odor:	odorless
pH:	data not available
Melting Point	data not available
Boiling Point	data not available
Ignition Point	data not available
Steam Press:	data not available
Specific Gravity:	3.5 - 4.0
Solubility:	insoluble

10. Stability and Reactivity

The following information is available regarding the stability of a elemental metal constituent of diamond impurity (cobalt, nickel, manganese and aluminum) and the hazardous reactions occurring under a specific condition.

- Cobalt

Stability:	• Stable against heat and contact with water. • Spontaneous ignition in air atmosphere.
Risk of Hazardous and Harmful Reaction:	• Reacts with strong oxidation agent. • Intensely reacts with oxygen and brings about risks of fire or explosion. • Intensely reacts with acid and generates hydrogen.
Conditions to be Avoided:	• Contact with hazardous contaminating substances.
Prohibited Substances from Contamination:	• Strong oxidation agent, acid.

Hazardous and Harmful Degradation Products:	• The cobalt oxide or the fumes of cobalt oxide may be generated by combustion.

• Nickel

Stability: Risk of Hazardous and Harmful Reaction:	• Regarded as stable under storage and handling in accordance with laws/regulations • Metal nickel is normally stable with the oxide layer against oxidation while the fresh surface without the oxide layer is rapidly oxidized by air. Consequently, there is a risk of ignition of fresh metal powder nickel in an air atmosphere.
Conditions to be Avoided:	• Data not available
Hazardous and Harmful Degradation Products:	• Data not available

• Manganese

Stability:	• Stable under normal handling conditions. • Toxic fumes are generated by heat.
Risk of Hazardous and Harmful Reaction:	• Intensely reacts with many non-metallic substances (chlorine, fluorine, oxygen, etc.) in high temperature and brings about the risk of fire or explosion. • Intensely reacts with hydrogen peroxide, bromine pentafluoride, nitrogen dioxide, and aluminum powder/dust and brings about the risk of fire or explosion. • Reacts with boron, carbon, silicon, phosphorus, sulfur, and oxidizer. • Reacts explosively with nitric acid and ammonium nitrate. • In powder form, reacts with water or steam and generates hydrogen. • Mixing with air in powder or granule form may cause a dust explosion.
Conditions to be Avoided:	• Heating to high temperature, mixing, and contact with contaminant hazardous substances.
Prohibited Substances from Contamination:	• Strong oxidation agent, strong acid, hydrogen peroxide, bromine pentafluoride, nitrogen dioxide, and non-metallic substances, aluminum powder/dust, etc.
Hazardous and Harmful Degradation Products:	• Irritant, corrosive, or toxic gas/fumes are generated by heating.

• Aluminum

Stability:	• Powder, foil, or ribbon is combustible by heat or contact with flame. • Non-combustible solid substance.
Risk of Hazardous and Harmful Reaction:	• The mixture with oxidation agent may be ignited by overheating, shock, or friction and may cause spontaneous ignition with humidity or moisture. • Mixing with air in powder or granule form may cause a dust explosion. • Contact with halogen elements may cause a spontaneous ignition. • Contact with water, acid, or alkaline will generate hydrogen, and the hydrogen may cause an explosion. • (Powder) Reacts with water or alcohol, and intensely reacts with oxidation agents, strong acids, or chlorinated hydrocarbon and brings about the risk of fire or explosion. • Mixing with air in powder or granule form may cause a dust explosion • Fire, friction, shock, etc., are strictly prohibited.
Conditions to be Avoided:	
Prohibited Substances from Contamination:	• Water, alkaline, acid, oxidizer, and alcohol.
Hazardous and Harmful Degradation Products:	• Data not available

11. Toxicological Information

Acute Toxicity:	No data available on diamond
Skin Corrosivity/Irritancy:	No data available on diamond
Critical eye Damage/Irritancy:	No data available on diamond
Respiratory Sensitization or Skin Sensitization:	No data available on diamond
Reproductive Cell Mutagenicity:	No data available on diamond
Carcinogenicity:	Cobalt powder is classified as group 2A by IARC: Carcinogenicity to human is presumed (Literature 1).
Reprotoxicity:	No data available on diamond
Specific Target Organ/Systemic Toxicity (single exposure):	No data available on diamond
Specific Target Organ/Systemic Toxicity (repetitive exposure):	No data available on diamond
Aspiration Hazard:	No data available on diamond

12. Ecological Information

12.1 Aquatic environment acute hazardous property

- No knowledge available on diamond

12.2 Aquatic environment chronic hazardous property

- No knowledge available on diamond

12.3 Mobility

- No knowledge available on diamond

13. Disposal Consideration

Method for safe and environmental preferred disposal:

- When disposing, a treatment shall be implemented in accordance with the laws regarding the industrial wastes such as the Waste Disposal and Public Cleansing Act and the relevant regulations or ordinances of prefecture or local government.

14. Transport Information

International Rules

UN No:	Not Applicable
UN Class:	Not Applicable
Marine Pollution Contaminants:	Not Applicable

Domestic Rules

Land Regulatory Information:	Not Applicable
UN No:	Not Applicable
UN Class:	Not Applicable
Marine Pollution Contaminants:	Not Applicable

15. Regulatory Information (Japanese Applicable Law)

Other Hazardous and Harmful Property Information

- If a quantity of powder/dust containing cobalt is swallowed, it may cause blood, cardiac, thyroid gland, and spleen disorders. (Reference 2)
- It is reported that repetitive or long-term contact with cobalt, nickel, or manganese may cause skin, respiratory, or heart symptoms. (References 3 – 6)

The following are the knowledges on the carcinogenicity by the impurities:

Cobalt	ACGIH	A3: A substance on which the carcinogenicity is recognized on animals but the relevance to human is unclear.
	IARC	2B: Possible carcinogenicity to human.
	JSOH	2B: A substance presumably carcinogenic to human (A substance with comparatively not enough evidence).
Nickel	ACGIH	A5: Not suspected as a human carcinogen.
	IARC	2B: Possible carcinogenicity to human.
Manganese	JSOH	2B: A substance presumably carcinogenic to human (A substance with comparatively not enough evidence).
	IARC	Classification is not applicable to the carcinogenicity to human.

*ACGIH: American Conference of Governmental Industrial Hygienists Inc.
*IARC: International Agency for Research on Cancer

Handling of Described Contents

The described information in this data sheet are prepared on the basis of currently available materials and information and are subject to possible changes due to acquisition of any new knowledge. The figures for the contained amount, physical/chemical properties, etc., are not guaranteed. Furthermore, the precautions are relevant only for normal handling operations, and consequently no guarantee is assured.

Reference URL

- Ministry of Economy, Trade and Industry: http://www.meti.go.jp/
- Environment Ministry (Act on Confirmation of the Release Amounts of Specific Chemical Substances in the Environment and Promotion of Improvements to the Management Thereof): http://www.env.go.jp/
- Ministry of Health, Labour and Welfare (Industrial Safety and Health Act): http://www.mhlw.go.jp/
- Japan Industrial Safety and Health Association: http://www.jaish.gr.jp/
- IARC (International Agency for Research on Cancer): http://monographs.iarc.fr/
- ICSC Card: http://www.nihs.go.jp/ICSC/
- National Institute of Technology and Evaluation: http://www.safe.nite.go.jp/ghs/list.html

Reference Literatures

(1) IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol.86 (2006).
(2) Food & Drug Research Laboratories, study No.8005B (4.11.84).
(3) T. Shirakawa et al., *Chest* 95, 29 (1989).
(4) International Chemical Safety Cards (cobalt, chromium, nickel, nickel oxide, magnesium oxide, aluminum oxide).
(5) Registry of Toxic Effects of Chemical Substances (issued by Japan Industrial Safety and Health Association)
(6) A. O. Bech et al., *Brit J Ind* 19, 239 (1962).

Revision Record

Established	April 5, 2019	