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MATERIAL SAFETY DATA SHEET

CHEMICAL IDENTIFICATION

Product: Rare Earth-Pentanickel Alloy and its Hydride

**No OSHA standards have been established for the alloy. Processing and handling alloy powder can generate respiratory particulates.

Manufactured by: Hydrogen Consultants, Inc.
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COMPOSITION/INFORMATION OF INGREDIENTS HAZARDS IDENTIFICATION

Fire & Explosion Data: Bureau of Mines Explosibility Index for hydrides of this type is 0.1 (weak). The lower explosive limit (LEL) for $MmNi_5$ (where Mm is mischmetal a mixture of the rare earth metals) is 0.052 oz/ft³ in the Factory Mutual test. Auto ignition temperature of the alloy powder (-100, +200 mesh) is believed to exceed 500°C and the powder, once ignited burns, gently. Hydrogen desorbing from burning hydride powder burns gently at the surface without explosion.

Extinguishing Media: Dry chemical, sand or mat. DO NOT USE WATER!

Reactivity Data: A clean metal surface reacts with O₂ and H₂O in the air to form a thin impervious coating which prevents further air oxidation. Reacts with acids with the evolution of hydrogen.

Health Hazard Information: Threshold Limit Value: 2.3 mg/m³ (based on components.)
Effects of overexposure: No acute respiratory reaction or chronic effects from exposure to this material have been observed. Proper industrial hygiene requires

maintenance of working atmosphere at concentrations below the recommended minimum component TLV.

Rare earth pentanickel alloys and hydrides are typically >60% nickel by weight >30% rare earth by weight and may contain aluminum, tin, or manganese additives. The MSDS sheets for the dilute additives are stapled to this document.

The following information relative to the Health Hazards of nickel powder has been excerpted from the MSDS of 13 Sept., 1985 by INCO, a primary nickel producer.

"Inhalation": The National Toxicology Program has listed nickel and nickel oxide as possible cancer hazards. The International Agency for Research on cancer concluded there was sufficient evidence that nickel and certain nickel compounds were carcinogenic to humans. IARC could not state with certainty which forms of nickel are human carcinogens but said "....metallic nickel seems less likely to be so than nickel subsulphide or nickel oxides." The inhalation of nickel oxide, even at high concentrations, and of nickel powder has not resulted in an increased incidence of malignant tumors in rodents. Studies of workers exposed to nickel powder and to dust and fume generated in the production of nickel alloys and of stainless steel have not indicated a respiratory cancer hazard.

Inhalation of airborne nickel powder at concentrations fifteen times the PEL irritated the respiratory tract in rodents. Inhalation of nickel oxide impaired long-term lung clearance in rats and, at concentrations fifty times the PEL, produced pneumoconiosis in hamsters.

Skin Contact: Repeated contact with metallic nickel can cause nickel sensitivity resulting in allergic skin rashes.

Wounds: Nickel powder and nickel oxide have caused tumors at the site of injection in rodents. However, studies of nickel-containing prostheses do not suggest a significant risk for humans.

Ingestion: Nickel metal and nickel oxide have low oral toxicities; their oral rat LD_{50s} are >9000 mg/kg and >5000 mg/kg respectively. The US Food and Drug Administration concluded that nickel and its inorganic compounds are not carcinogenic when ingested.

Preexisting Conditions: Sensitized individuals may experience an allergic skin rash.

Emergency and First Aid Procedures: Remove to fresh air. Wash eyes and areas of skin contact with copious amounts of clear water. For skin rashes, seek medical attention. Cleanse wounds thoroughly to remove all particles."

Spill, Leak, and Disposal Procedures: Can be swept and/or shoveled up and replaced in original container. Care should be taken to maintain work area

atmosphere below the minimum component TLV level. Unsalvageable waste can be reprocessed for metal content or deposited in approved landfill.

Special Protection Information: Good industrial hygiene practice requires that employee exposure be maintained below the recommended minimum component TLV. This is preferably achieved through the provision of adequate ventilation where necessary. Where dust or fume cannot be controlled in this way, personal respiratory protection should be employed and according to the severity of the situation, consideration should be given to the use of barrier creams and protective clothing.

Respiratory Protection: In an environment where the "Airborne Contaminant Concentration" of metallic powder is greater than the applicable Threshold Limit Value (TLV) use WILLSON Type 1211 respirator or Mine Safety Appliance Co. Model 459438 or other NIOSH-approved equivalent respirator. For high concentration of fumes and/or dust it is suggested that a supplied-air respiratory device be used.

Ventilation: The area surrounding processing operations should be suitably ventilated to prevent airborne dust from collecting to a level in excess of the minimum component TLV.

Protective Gloves: Should be worn in handling drums and in handling alloy or hydride dust.

Eye Protection: The eyes should be protected from any possible incursion by alloy or hydride dust.

Special Precautions and Comments: This alloy should be stored in closed containers in a dry, low fire risk area..