MATERIALS SAFETY DATA SHEET

HY-STOR® 207 ALLOY

Manufactured by: ERGENICS, INC.
247 Margaret King Avenue
Ringwood, NJ 07456
973-962-4480

SECTION I. MATERIAL IDENTIFICATION

Material Name: Lanthanum-nickel-aluminum alloy powder.
Description: Hard, brittle, intermetallic compound; crushed ingot; powder.
Use: Reversible storage of hydrogen gas as a solid metal hydride.

SECTION II. INGREDIENTS AND HAZARDS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Composition, wt%</th>
<th>C.A.S. No.</th>
<th>OSHA PEL mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>nickel (Ni)</td>
<td>65.3</td>
<td>7440-02-0</td>
<td>1.0</td>
</tr>
<tr>
<td>lanthanum (La)</td>
<td>32.8</td>
<td>7439-91-0</td>
<td>not listed</td>
</tr>
<tr>
<td>aluminum (Al)</td>
<td>1.9</td>
<td>7429-90-5</td>
<td>15.0</td>
</tr>
</tbody>
</table>

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

OSHA PEL from 29CFR1910.1000, Table Z-1

SECTION III. PHYSICAL DATA

Chemical formula - LaNi₅₃Al₃
Specific gravity (g/cm³) - 8.0
Boiling point, °C - NA
Melting point, °C - 1260
Vapor pressure - NA
Solubility in water - insoluble
Appearance - silvery metallic solid
Specific heat (cal/g °C) - 0.1 (room temp. to 100°C)

SECTION IV. FIRE AND EXPLOSION DATA

Bureau of Mines Explosibility Index for LaNi₅₃H₅ (the hydride form of a closely related compound) is 0.1 (weak). The lower explosive limit (LEL) for MmNi₅ (where Mm is mischmetal, a mixture of the rare earth metals including about 35% La) is 0.052 oz/ft³ in the Factory Mutual test. Auto ignition temperature of the alloy powder (-100, +200 mesh) is believed
Hy-Stor 207 Alloy

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MSDS

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!

SECTION V. 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. Reacts reversibly with hydrogen gas to form LaNi₄Al₆H₆.

SECTION VI. HEALTH HAZARD INFORMATION

Permissible Exposure Limit: 1.0 mg/m³ (based on the most hazardous component).

Effects of overexposure: No acute respiratory reaction or chronic effects from exposure to powder have been observed. Proper industrial hygiene requires maintenance of working atmosphere at concentrations below the recommended minimum component 8 hour Time Weighted Average (TWA) (1.0 mg/m³).

Inhalation: 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 LD₅₀ are >9000 mg/kg and >5000 mg/kg respectively. The U.S. 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.

SECTION VII. 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 TWA level. Unsalvageable waste can be reprocessed for metal content or deposited in approved landfill.
Hy-Stor 207 Alloy

SECTION VIII. SPECIAL PROTECTION INFORMATION

Good industrial hygiene practice requires that employee exposure be maintained below the recommended minimum component TWA. 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 TWA use WILSON 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 alloy processing operations should be suitably ventilated to prevent airborne dust from collecting to a level in excess of the minimum component TWA.

PROTECTIVE GLOVES: Should be worn in handling drums of alloy and in handling the alloy itself.

EYE PROTECTION: The eyes should be suitably protected from any possible incursion by alloy dust.

SECTION X. SPECIAL PRECAUTIONS AND COMMENTS

Alloy should be stored in closed containers in a dry, low fire risk area.

Judgements as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, ERGENICS, INC. extends no warranties, makes no representations and assumes no responsibilities as to the accuracy or suitability of such information for application to purchaser's intended purposes or for consequences of its use.

D.C. Tragna
February 27, 2001
MATERIALS SAFETY DATA SHEET

HY-STOR® 210 ALLOY

Manufactured by: ERGENICS, INC.
247 Margaret King Avenue
Ringwood, NJ 07456
973-962-4480

SECTION I. MATERIAL IDENTIFICATION

Material Name: Lanthanum-nickel-aluminum alloy powder.
Description: Hard, brittle, intermetallic compound; crushed ingot; powder.
Use: Reversible storage of hydrogen gas as a solid metal hydride.

SECTION II. INGREDIENTS AND HAZARDS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Composition, wt%</th>
<th>C.A.S. No.</th>
<th>OSHA PEL mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>nickel (Ni)</td>
<td>61.3</td>
<td>7440-02-0</td>
<td>1.0</td>
</tr>
<tr>
<td>lanthanum (La)</td>
<td>33.7</td>
<td>7439-91-0</td>
<td>not listed</td>
</tr>
<tr>
<td>aluminum (Al)</td>
<td>5.0</td>
<td>7429-90-5</td>
<td>15.0</td>
</tr>
</tbody>
</table>

No OSHA standards have been established for the alloy.

Processing and handling alloy powder can generate respirable particulates.

OSHA PEL from 29CFR1910.1000, Table Z-1

SECTION III. PHYSICAL DATA

Chemical formula - LaNi₄₂₅Al₃₇₅
Specific gravity (g/cm³) - 8.0
Boiling point, °C - NA
Melting point, °C - 1260
Vapor pressure - NA
Solubility in water - insoluble
Appearance - silvery metallic solid
Specific heat (cal/g°C) - 0.1 (room temp. to 100°C)

SECTION IV. FIRE AND EXPLOSION DATA

Bureau of Mines Explosibility Index for LaNi₄H₆ (the hydride form of a closely related compound) is 0.1 (weak). The lower explosive limit (LEL) for MnNi₄ (where Mn is mishmetal, a mixture of the rare earth metals including about 35% La) is 0.052 oz/ft³ in the Factory Mutual test. Auto ignition temperature of the alloy powder (-100, +200 mesh) is believed
Hy-Stor 210 Alloy

-2-

MSDS

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!

SECTION V. 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. Reacts reversibly with hydrogen gas to form LaNi₄Al₄₇H₄.

SECTION VI. HEALTH HAZARD INFORMATION

Permissible Exposure Limit: 1.0 mg/m³ (based on the most hazardous component).

Effects of overexposure: No acute respiratory reaction or chronic effects from exposure to powder have been observed. Proper industrial hygiene requires maintenance of working atmosphere at concentrations below the recommended minimum component 8 hour Time Weighted Average (TWA) (1.0 mg/m³).

Inhalation: 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 LD₅₀ are >9000 mg/kg and >5000 mg/kg respectively. The U.S. 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.

SECTION VII. 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 TWA level. Unsalvageable waste can be reprocessed for metal content or deposited in approved landfill.
Hy-Stor 210 Alloy

SECTION VIII. SPECIAL PROTECTION INFORMATION

Good industrial hygiene practice requires that employee exposure be maintained below the recommended minimum component TWA. 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 TWA use WILSON 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 alloy processing operations should be suitably ventilated to prevent airborne dust from collecting to a level in excess of the minimum component TWA.

PROTECTIVE GLOVES: Should be worn in handling drums of alloy and in handling the alloy itself.

EYE PROTECTION: The eyes should be suitably protected from any possible incursion by alloy dust.

SECTION X. SPECIAL PRECAUTIONS AND COMMENTS

Alloy should be stored in closed containers in a dry, low fire risk area.

Judgements as to the suitability of information herein for purchaser’s purposes are necessarily purchaser’s responsibility. Therefore, although reasonable care has been taken in the preparation of such information, ERGENICS, INC. extends no warranties, makes no representations and assumes no responsibilities as to the accuracy or suitability of such information for application to purchaser’s intended purposes or for consequences of its use.

D.C. Tragna
February 27, 2001
Hy-Stor 301 Alloy

MATERIAL SAFETY DATA SHEET

HY-STORE® 301 ALLOY

Manufactured by: ERGENICS, INC.
247 Margaret King Avenue
Ringwood, NJ 07456
973-962-4480

SECTION I. MATERIAL IDENTIFICATION

Material Name: Hy-Stor 301, magnesium-nickel alloy powder.
Description: Hard, brittle, intermetallic compound; crushed ingot; powder.
Use: Reversible storage of hydrogen gas as a solid metal hydride.

SECTION II. INGREDIENTS AND HAZARDS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Composition, wt%</th>
<th>C.A.S. No.</th>
<th>OSHA PEL mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>nickel (Ni)</td>
<td>50.0</td>
<td>7440-02-0</td>
<td>1.0</td>
</tr>
<tr>
<td>magnesium (Mg)</td>
<td>50.0</td>
<td>7439-95-4</td>
<td>not listed</td>
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</table>

No OSHA standards have been established for the alloy.

Processing and handling alloy powder can generate respirable particulates.

OSHA PEL from 29CFR1910.1000, Table Z-1

SECTION III. PHYSICAL DATA

Chemical formula - Mg₀.₆Ni
Specific gravity (g/cm³) - 6.6
Boiling point, °C - NA
Melting point, °C - 508
Vapor pressure - NA
Solubility in water - reacts slowly
Appearance - grey metallic solid
Specific heat (cal/g°C) - 0.18 (room temp. to 100°C)

SECTION IV. FIRE AND EXPLOSION DATA

Airborne magnesium powder represents an EXPLOSION HAZARD. The lower explosive limit (LEL) for CaNi₂, a related hydriding compound, is 0.78 oz/ft³ in the Factory Mutual test. Once ignited, the alloy burns gently. Hydrogen desorbing from burning hydride powder burns gently at the surface without explosion.
Hy-Stor 301 Alloy

Extinguishing media: dry chemical, sand or mat. DO NOT USE WATER!

SECTION V. REACTIVITY DATA

A clean metal surface reacts with O₂ and H₂O in the air to form a porous of magnesium oxide or hydroxide. Reacts with acids with the evolution of hydrogen. Reacts reversibly with hydrogen gas to form Mg₂NiH₆.

SECTION VI. HEALTH HAZARD INFORMATION

Permissible Exposure Limit: 1.0 mg/m³ (based on the most hazardous component).

Effects of overexposure: No acute respiratory reaction or chronic effects from exposure to powder have been observed. Proper industrial hygiene requires maintenance of working atmosphere at concentrations below the recommended minimum component 8 hour Time Weighted Average (TWA) (1.0 mg/m³).

Inhalation: 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 LD₅₀ are >9000 mg/kg and >5000 mg/kg respectively. The U.S. Food and Drug Administration concluded that nickel and its inorganic compounds are not carcinogenic when ingested.

Precipitating 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.

SECTION VII. 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 TWA level. Unsalvageable waste can be reprocessed for metal content or deposited in approved landfill.
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Good industrial hygiene practice requires that employee exposure be maintained below the recommended minimum component TWA. 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 TWA use WILSON 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 alloy processing operations should be suitably ventilated to prevent airborne dust from collecting to a level in excess of the minimum component TWA.

PROTECTIVE GLOVES: Should be worn in handling drums of alloy and in handling the alloy itself.

EYE PROTECTION: The eyes should be suitably protected from any possible incursion by alloy dust.

SECTION X. SPECIAL PRECAUTIONS AND COMMENTS

Alloy should be stored in closed containers in a dry, low fire risk area.

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D.C. Tragna
February 27, 2001