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

1.1 Product identifier

Trade name: Thermoelectric Material - VACOTHERM®

Detailed descriptions:
VACOTHERM® p

® registered trademark of VACUUMSCHMELZE GmbH & Co. KG

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

Not applicable

Application of the article: Active material (legs) in thermoelectric modules

1.3 Details of the supplier of the information sheet

Manufacturer/Supplier:
VACUUMSCHMELZE GmbH & Co.KG
Grüner Weg 37
D-63450 Hanau
datasheet@vacuumschmelze.com

Further information obtainable from: Environmental Protection Department

1.4 Emergency telephone number:
Tel. no.: (**49) 6181/38-0
Emergency tel. no.: via (**49) 6181/38-0

SECTION 2: Hazards identification

2.2 Classification (substance or mixture)

Classification according to Regulation (EC) No 1272/2008 (CLP-Regulation):
Not applicable
For articles there is no obligation to classify acc. to CLP -Regulation.

2.2 Labelling according to Regulation (EC) No 1272/2008

Labelling according to Regulation (EC) No 1272/2008 (CLP-Regulation):
Not applicable

Additional VAC information:

In the case of dust-producing processing, we recommend observance of the following warnings:

The hazard statements result from the ingredients (composition) of the alloy and the applied nickel coating.

Hazard statements
May cause an allergic skin reaction.
Suspected of causing cancer. Route of exposure: Inhalation.
May cause damage to the respiratory system through prolonged or repeated exposure. Route of exposure: Inhalation.

Precautionary statements
Do not breathe dust/fume/gas/mist/vapours/spray.
Wear protective gloves/protective clothing/eye protection/face protection/hearing protection.
IF exposed or concerned: Get medical advice/attention.
Specific treatment (see on this label).
If skin irritation or rash occurs: Get medical advice/attention.

(Contd. on page 2)
Dispose of contents/container in accordance with local/regional/national/international regulations.

- **2.3 Other hazards**
  
  **Dry mechanical processing** is only permitted under special safety precautions because dusts which are capable of self-heating or pyrophorous dusts with a tendency to explode may be produced.  
  **In the case of wet mechanical processing:** The resulting processing sludges must be kept under a protective liquid because drying out sludges are capable of self-heating or may react pyrophorously.

- **Results of PBT and vPvB assessment**
  
  - **PBT:** Not applicable.
  - **vPvB:** Not applicable.

### SECTION 3: Composition/information on ingredients

- **3.2 Chemical characterization:**
  
  - **Description:** Metal in compact form
  
  - **Components:**

    The classifications given below reflect the classification of each pure substance respectively and are intended for information only.

    The legal classifications of the pure substances (harmonized classification according to substance list of the Annex VI of the CLP Regulation) got complemented, insofar as additional substance-specific information from accessible data sources (e.g. TRGS 905, toxicological studies) for health hazards and / or physical hazards are available.

    The following classification of the physical hazards refers to the substances in form of powders only.

    | CAS: 7440-36-0 | antimony | rest% |
    | 7440-03-1 | niobium (powder) | 20-30% |
    | 7439-89-6 | iron (powder) | 15-25% |
    | 7440-32-6 | titanium (powder) | <5% |
    | 7440-02-0 | nickel | *(coating)*% |

    - **CAS: 7440-31-5** | tin | <5% |
    - **CAS: 7440-62-2** | vanadium | <5% |

  - **Remark to the composition:**

    - * Essential part of plating
      Nickel, Nickel/Gold or Nickel/Silver)

  - **Additional information:**

  (Contd. on page 3)
SECTION 4: First aid measures

• 4.1 Description of first aid measures

• After inhalation:
  If metal vapours or dusts have been inhaled:
  Get the affected person out in the fresh air and call a doctor.

• After skin contact:
  Foreign bodies which have penetrated the skin must be removed and the wound cleaned thoroughly.

• After eye contact:
  Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.

• After swallowing:
  Consult a doctor if the symptoms persist.

• 4.2 Most important symptoms and effects, both acute and delayed
  No further relevant information available.

• 4.3 Indication of any immediate medical attention and special treatment needed
  No further relevant information available.

SECTION 5: Firefighting measures

• 5.1 Extinguishing media
  Suitable extinguishing agents: Special powder for metal fires. Do not use water.

• For safety reasons unsuitable extinguishing agents: Water

• 5.2 Special hazards arising from the substance or mixture
  Formation of toxic smoke / fumes (metal / metal oxides) is possible during heating or in case of fire. Do not inhale fumes.

• 5.3 Advice for firefighters
  Protective equipment: No special measures required.

SECTION 6: Accidental release measures

Accidental release of dusts and vapours which are damaging to health can be ruled out.

• 6.1 Personal precautions, protective equipment and emergency procedures
  No special measures required.

• 6.2 Environmental precautions:
  No special measures required.

• 6.3 Methods and material for containment and cleaning up:
  No special measures required.

• 6.4 Reference to other sections
  See Section 7 for information on safe handling.
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.

SECTION 7: Handling and storage

• 7.1 Precautions for safe handling
  No safety precautions are necessary in the delivered form.
  The appropriate industrial and environmental safety measures must be taken for processing steps which cause dust
  (see also section 8):
  Prevent formation of dust.
  Ensure good ventilation/exhaustion at the workplace.
  Take note of emission threshold.
  Dry mechanical processing is only permitted under special safety precautions because dusts which are capable of self-heating or pyrophorous dusts with a tendency to explode may be produced.

In the case of wet mechanical processing:
  The resulting processing sludges must be kept under a protective liquid because drying out sludges are capable of self-heating or may react pyrophorously.
Information about fire - and explosion protection: No particular measures are required in the provided form.

7.2 Conditions for safe storage, including any incompatibilities

Storage:

Requirements to be met by storerooms and receptacles: No special requirements.

Information about storage in one common storage facility: Not required.

Further information about storage conditions: Not applicable

Storage class: Not applicable

7.3 Specific end use(s) No further relevant information available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Additional information about design of technical facilities:

Suction and filtering and good ventilation of the working area must be provided for processes where dust is formed.

Approved industrial vacuum cleaners of at least dust class L must be used (DIN EN 60335-2-69).

Suitable breathing apparatus must be used during repair and maintenance work on suction systems (see personal safety equipment).

Ingredients with limit values that require monitoring at the workplace:

For International Limit Values see Additional information below.

<table>
<thead>
<tr>
<th>Substance</th>
<th>MAK (Germany)</th>
<th>MAK (Germany)</th>
</tr>
</thead>
<tbody>
<tr>
<td>antimony</td>
<td>vgl.Abschn.XII</td>
<td>vgl.Abschn.XII</td>
</tr>
<tr>
<td>tin</td>
<td>vgl.Abschn.II</td>
<td>vgl.Abschn.II</td>
</tr>
<tr>
<td>vanadium</td>
<td>einatembare Fraktion; vgl. Abschn. XIII</td>
<td>einatembare Fraktion; vgl. Abschn. XIII</td>
</tr>
<tr>
<td>nickel</td>
<td>Long-term value: 0.006A; 0.030E* mg/m³</td>
<td>Long-term value: 0.006A; 0.030E* mg/m³</td>
</tr>
</tbody>
</table>

DNELs

DNELs for OSH purposes

In Germany, occupational exposure limits (AGW) of the Technical Rules on Hazardous Substances (TRGS) 900 continue to constitute workplace atmospheric limit values that are binding upon employers. Should no AGW and for example no maximum workplace concentration (MAK value) of the German Research Foundation (DFG) be available, the employer must also consider the DNEL during risk assessment.

(Source: Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung (IFA))

Current values are available: http://www.dguv.de/ifa/Gestis/Gestis-dnel-liste/index.jsp.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Inh. Long-term exposure - inhalation - local effects</th>
<th>Inh. Long-term exposure - inhalation - systemic effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>nickel</td>
<td>0.05 mg/m³ (Ind)</td>
<td>0.05 mg/m³ (Ind)</td>
</tr>
</tbody>
</table>

Additional Occupational Exposure Limit Values for possible hazards during processing:

Compliance with the general dust limit value(s) (lung penetrating and/or inhalable fraction) must be ensured. The AGW for nickel is to be used only for nickel metal.

For thermal processes in the presence of atmospheric oxygen, oxidic nickel compounds must always be assumed and the ERB (TRGS 910) must be applied.

Additional information:

- The lists valid during the making were used as basis.

(Contd. on page 5)
• **8.2 Exposure controls**

**Personal protective equipment:**

**General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed. Wash hands before breaks and at the end of work.

**Respiratory protection:**
In the case of dust formation (limit value exceeded), breathing apparatus must be worn. Time limits for wearing must be observed.

Breathing mask, apparatus with particle filter P2 or P3, for example:
- Full face mask (EN 136)
- Breathing mask (EN 149) FFP2 or FFP3
10 times the limit value (FFP2)
30 times the limit value (FFP3)
Recommendation: P3

**Protection of hands:**
Avoid repeated and prolonged contact with the skin, use protective gloves.
Preventive skin protection by use of skin-protecting agents is recommended.

**Material of gloves**
Experience has shown glove materials polychloroprene, nitrile caoutchouc, butyl caoutchouc, fluoride caoutchouc and polyvinylchloride to offer sufficient protection.

- **Penetration time of glove material** Omitted

**Eye protection:**
In the event of larger quantities of dust:
Wear protective glasses / EN 166, poss. with side protection.

**Limitation and supervision of exposure into the environment**
The legal issue values and limitations are to be paid attention!

---

**SECTION 9: Physical and chemical properties**

<table>
<thead>
<tr>
<th>9.1 Information on basic physical and chemical properties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Information</strong> The physical and chemical properties of this section refer to the unplated alloy.</td>
</tr>
<tr>
<td><strong>Appearance</strong></td>
</tr>
<tr>
<td><strong>Form</strong></td>
</tr>
<tr>
<td>Blocks/ingots, discs, etc. of different size and weight</td>
</tr>
<tr>
<td><strong>Colour</strong></td>
</tr>
<tr>
<td>Metallic</td>
</tr>
<tr>
<td><strong>Odour</strong></td>
</tr>
<tr>
<td>Metallic</td>
</tr>
<tr>
<td><strong>pH-value</strong></td>
</tr>
<tr>
<td>Not applicable.</td>
</tr>
<tr>
<td><strong>Change in condition</strong></td>
</tr>
<tr>
<td>Melting point/Melting range (approx.): 1,050-1,150 °C</td>
</tr>
<tr>
<td><strong>Auto-ignition temperature</strong></td>
</tr>
<tr>
<td>Omitted (in the provided form). Also see section 2 and/or 7.</td>
</tr>
<tr>
<td><strong>Explosive properties</strong></td>
</tr>
<tr>
<td>Omitted (in the provided form). Also see section 2 and/or 7.</td>
</tr>
<tr>
<td><strong>Vapour pressure</strong></td>
</tr>
<tr>
<td>Not determined.</td>
</tr>
</tbody>
</table>
• Density (approx.) at 20 °C: 8.1 g/cm³
• Relative density Not determined.
• Solubility in / Miscibility with water: Insoluble.
• 9.2 Other information No further relevant information available.

SECTION 10: Stability and reactivity

• 10.1 Reactivity No further relevant information available.
• 10.2 Chemical stability
• Thermal decomposition / conditions to be avoided: No decomposition if used according to specifications.
• 10.3 Possibility of hazardous reactions
Hydrogen is released in contact with acid which can cause explosive gas mixtures.
• 10.4 Conditions to avoid No further relevant information available.
• 10.5 Incompatible materials: No further relevant information available.
• 10.6 Hazardous decomposition products: No dangerous decomposition products known.

SECTION 11: Toxicological information

• 11.1 Information on toxicological effects
• Acute toxicity Based on available data, the classification criteria are not met.

<table>
<thead>
<tr>
<th>LD/LC50 values:</th>
</tr>
</thead>
<tbody>
<tr>
<td>7440-36-0 antimony Oral [LD50] 7,000 mg/kg (rat)</td>
</tr>
<tr>
<td>7440-02-0 nickel Oral [LD50] &gt;9,000 mg/kg (rat)</td>
</tr>
</tbody>
</table>

• Primary irritant effect:
• Skin corrosion/irritation Based on available data, the classification criteria are not met.
• Serious eye damage/irritation Irritation of the eyes in the case of massive direct contact will be mainly due to mechanical effects depending on the grain size.
• Respiratory or skin sensitisation May cause an allergic skin reaction.
• Additional Information:
• Repeated dose toxicity
• Germ cell mutagenicity Based on available data, the classification criteria are not met.
• Carcinogenicity Suspected of causing cancer. Route of exposure: Inhalation.
• Reproductive toxicity Based on available data, the classification criteria are not met.
• STOT-single exposure Based on available data, the classification criteria are not met.
• STOT-repeated exposure May cause damage to the respiratory system through prolonged or repeated exposure. Route of exposure: Inhalation.
• Aspiration hazard Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

• 12.1 Toxicity
• Aquatic toxicity: No further relevant information available.
• 12.2 Persistence and degradability No further relevant information available.
• 12.3 Bioaccumulative potential No further relevant information available.
• 12.4 Mobility in soil No further relevant information available.
• Additional ecological information:
  • General notes:
    Generally not hazardous for water (german regulations)
    Alloys in solid form do not pose an ecological threat.
  • 12.5 Results of PBT and vPvB assessment
    • PBT: Not applicable.
    • vPvB: Not applicable.
  • 12.6 Other adverse effects No further relevant information available.

SECTION 13: Disposal considerations

• 13.1 Waste treatment methods
  • Recommendation Observe official regulations.
  • Uncleaned packaging: Not applicable

SECTION 14: Transport information

• Transport/Additional information:
  • Land transport ADR/RID (cross-border):
    • Remarks: Non-hazardous goods from the standpoint of the specified regulations
  • Maritime transport IMDG:
    • Remarks: Non-hazardous goods from the standpoint of the specified regulations
  • Air Transport ICAO-TI and IATA-DGR:
    • Remarks: Non-hazardous goods from the standpoint of the specified regulations

SECTION 15: Regulatory information

• 15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
  • Directive 2012/18/EU
  • Named dangerous substances - ANNEX I None of the ingredients is listed.
  • REGULATION (EC) No 1907/2006 ANNEX XVII Conditions of restriction: 27
  • DIRECTIVE 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment – Annex II
    None of the ingredients is listed.
  • National regulations:
    • Other regulations, limitations and prohibitive regulations
      e.g.
      - 1272/2008/EG (CLP)
      - 1907/2006/EG (REACH)
      - German Hazardous Substances
      - TRGS 561 / TRGS 910
  • 15.2 Chemical safety assessment: Void (for articles)

SECTION 16: Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.
• Reasons for alterations
   The material safety data sheet has been re-compiled in connection with the 28th adaptation of regulation 67/548/EEC.
   All previous safety data sheets become invalid.

• Relevant phrases
   Wording of the hazard warnings mentioned (Chapter 3) for pure substances:
   H228 Flammable solid.
   H250 Catches fire spontaneously if exposed to air.
   H251 Self-heating: may catch fire.
   H317 May cause an allergic skin reaction.
   H351 Suspected of causing cancer.
   H372 Causes damage to organs through prolonged or repeated exposure.

• Department issuing SDS:
   Department OPS-C SE
   Tel. 06181/38-2045

• Contact:
   Environmental Protection Department
   Tel. 06181/38-2359

• Abbreviations and acronyms:
   ADR: Accord relatif au transport international des marchandises dangereuses par route (European Agreement Concerning the International Carriage of Dangerous Goods by Road)
   IMDG: International Maritime Code for Dangerous Goods
   IATA: International Air Transport Association
   EINECS: European Inventory of Existing Commercial Chemical Substances
   ELINCS: European List of Notified Chemical Substances
   CAS: Chemical Abstracts Service (division of the American Chemical Society)
   DNEL: Derived No-Effect Level (REACH)
   LC50: Lethal concentration, 50 percent
   LD50: Lethal dose, 50 percent
   PBT: Persistent, Bioaccumulative and Toxic
   vPvB: very Persistent and very Bioaccumulative
   Flam. Sol. 2: Flammable solids – Category 2
   Pyr. Sol. 1: Pyrophoric solids – Category 1
   Self-heat. 1: Self-heating substances and mixtures – Category 1
   Skin Sens. 1: Skin sensitisation – Category 1
   STOT RE 1: Specific target organ toxicity (repeated exposure) – Category 1
   STOT RE 2: Specific target organ toxicity (repeated exposure) – Category 2

• Sources
   - KÜHN-BIRETT-Merkblätter gefährlicher Arbeitsstoffe
   - Technische Regeln für Gefahrstoffe

* Data compared to the previous version altered.