MATERIAL SAFETY DATA SHEET


Section 1. Identification of Chemical Substance and Company

1.1. PRODUCTS IDENTIFICATION: Zp™130 powder

1.2. USE OF SUBSTANCE: Plaster powder for making rapid-prototyping 3D models.

1.3. COMPANY: Z Corporation
32 Second Ave.
Burlington, MA 01803
Contact Person: Manager of Technical Services
Telephone Number: 781-852-5005

Foreign Contact: +(45) 48 14 11 22
Svanevang 2, 3450 Allerød, Denmark

Date of Preparation: 8/04
Date Revised: 2/23/06, 4/13/06, 1/4/07

1.4. EMERGENCY TELEPHONE: 781-852-5005

Section 2. Composition/Information of Ingredients

Substance is a mixture with following general composition:

<table>
<thead>
<tr>
<th>Component Classified As Dangerous (CHIP3)</th>
<th>Approximate % by weight</th>
<th>C.A.S. No. &amp; EINECS No.</th>
<th>UK/EU Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Plaster which contains Crystalline Silica(^1) at &lt;1%</td>
<td>50-95%</td>
<td>Trade Secret</td>
<td>None</td>
</tr>
<tr>
<td>2. Vinyl Polymer</td>
<td>2-20%</td>
<td>Trade Secret</td>
<td>S22, S26, S51</td>
</tr>
<tr>
<td>3. Sulfate Salt</td>
<td>0-5%</td>
<td>Trade Secret</td>
<td>S22, S24/25</td>
</tr>
</tbody>
</table>

Section 3. Hazard Identification

Potential Human Health Effects:
May cause irritation of the eyes, mucous membranes, and respiratory tract. May be harmful by inhalation or ingestion. Eye contact may cause mechanical abrasion with burning, tearing and redness. Ingestion may cause gastrointestinal disturbances such as upset stomach and intestinal irritation.

Target Organs or Systems:
Caution: May cause irritation to the eyes, skin, mucous membranes, upper respiratory tract. If ingested, toxic reactions due to bioaccumulation may occur.

\(^1\) There is <0.1% respirable crystalline silica, no exceedance of OSHA/TLV anticipated.
Route of Exposure:

**Skin Contact:** Repeated contact may dry the skin, causing cracking and dermatitis (rash). Sensitive individuals may develop an allergic dermatitis. When mixed with water, this material hardens and then slowly becomes hot. DO NOT attempt to make a cast enclosing any part of the body using this material. This can result in severe burns.

**Eye Contact:** May cause eye irritation.

**Inhalation:** May be harmful if inhaled. Material may be irritating to the mucous membranes and upper respiratory tract.

**Ingestion:** Toxic reactions due to bioaccumulation may occur. Inflammation of mouth, throat, esophagus and/or stomach.

Signs and Symptoms of Exposure:

Prolonged exposure can cause: Nausea, headache, and vomiting.

**Acute:**

May cause irritation of the eyes, skin, mucous membranes, and respiratory tract. May be harmful by inhalation, ingestion, or skin absorption.

**Chronic:**

- **Inhalation:** Pre-existing upper respiratory and lung disease may be aggravated by exposure. Prolonged inhalation of dust may cause pneumoconiosis. Prolonged and repeated exposure to respirable crystalline silica can result in lung disease (i.e. silicosis) and/or lung cancer. The product does not contain detectable levels of respirable silica based on the plaster manufacturer's test data and the overall total weight of crystalline silica is less than 1% in the product. If the final models are sanded, ground or pulverized, low levels of respirable dust may be generated that contain respirable fractions of silica. Thus the actual workplace exposure must be determined by workplace exposure testing.
- **Skin:** Repeated contact may dry the skin, causing cracking and dermatitis (rash). Sensitive individuals may develop an allergic dermatitis.

Carcinogens Under OSHA, ACGIH, NTP, IARC, OTHER:

This product contains less than 1% by weight of crystalline silica and there is less than 0.1% respirable crystalline silica. Only OSHA specifically regulates the respirable fraction of crystalline. Respirable silica is listed as cancer agent by ACGIH, IARC as Group 1 and NTP as human carcinogen. All other ingredients in this product contain no carcinogens in concentrations of 0.1 percent or greater based on U.S. and European chemical data base information.

Potential Environmental Effects:

No significant environmental hazards are expected if material is released to the environment.

**Section 4. Emergency First Aid**

- **Inhalation:** Remove from area to fresh air. Seek medical attention if respiratory irritation develops or if breathing becomes difficult.

- **Eye Contact:** Immediately flush eyes with copious amounts of water for at least 15 minutes. Call physician if irritation continues.

- **Skin Contact:** Immediately wash skin with soap and rinse with large amounts of water. Remove and wash contaminated clothing promptly. If skin has become cracked, take appropriate action to prevent infection and promote healing.

- **Ingestion:** Wash out mouth with water provided the person is conscious and seek medical attention. Plaster hardens when wetted and, if ingested, may result in obstruction.
Section 5. Fire and Explosion Hazard

Flash point (Method Used) Flammable limits LEL UEL
Not Applicable Not Applicable Not Applicable

Product is not combustible.

Extinguishing Media:
Water spray do not use solid stream of water or Class AB fire extinguisher
If unconfined, ignition of the powder will give rise to a Class A fire. In case of fire use water streams.

Special Fire Fighting Procedures
As with all fires, fire fighters should wear full protective gear including supplied air respirators.

Unusual Fire & Explosion:
Emits toxic fumes under fire conditions. Avoid conditions, which produce dust.

Exposure Hazard(s): Material: Irritant

Section 6. Accidental Release Measures

Procedures of Personal Precautions:
Wear respirator, chemical safety goggles, and chemical gloves.

Environmental Precautions:
No significant environmental hazards identified. Surfaces subject to spills or dusting with this product can become slippery when wet, use care to avoid falls.

Methods of Cleaning Up:
Sweep or vacuum material from spillage into a waste container for disposal. Avoid production of dust. Do not flush down drains. Place in closed containers. Ventilate area and wash spill site after material pickup is complete.

Waste Disposal Method:
Follow safe solid waste disposal guidelines in accordance with federal, state and local regulations. National or regional provisions may also be in force.

Section 7. Storage and Handling

Handling Precautions:
User Exposure: Avoid handling procedures that produce high levels of dust.

Storage Precautions:
Suitable: Store product in a cool, dry, ventilated area away from sources of heat, moisture, strong oxidizing materials and explosives. Keep containers tightly closed.

Special Requirements:
Under planned use this product should not result in excessive dust or hazards to the user following the recommended processes for creating prototype models.

Section 8. Exposure Controls & Personal Protection

Exposure Limit Values:
The European Member States have different standards for the components in this preparation. These powders are potentially irritant dusts with general exposure standard of 10 mg/m³. Particulates not otherwise classified (total dust) in Germany are 6 mg/m³ and10 mg/m³ in other European Countries. The respirable dust levels are 5 mg/m³.

<table>
<thead>
<tr>
<th>Component</th>
<th>IOELVs (UK)</th>
<th>EC OEL</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Plaster which contains Crystalline Silica\(^2\) at <1%  
<table>
<thead>
<tr>
<th></th>
<th>6 mg/m(^3) R</th>
<th>10 mg/m(^3)</th>
<th>10 mg/m(^3) Inhalable</th>
<th>15 mg/m(^3) Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.3 mg/m(^3) total</td>
<td>0.1 mg/m(^3) R</td>
<td>3 mg/m(^3) R</td>
<td>5 mg/m(^3) Respirable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 mg/m(^3)</td>
<td>10 mg/m(^3) Inhalable</td>
<td>10 mg/m(^3) / % Silica + 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 mg/m(^3) R</td>
<td>10 mg/m(^3) / % Silica + 2</td>
<td></td>
</tr>
</tbody>
</table>

2. Vinyl Polymer  
<table>
<thead>
<tr>
<th></th>
<th>4 mg/m(^3) Inhalable</th>
<th>1.5 mg/m(^3) R</th>
<th>10 mg/m(^3)</th>
<th>15 mg/m(^3) Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 mg/m(^3) Inhalable</td>
<td>3 mg/m(^3) R</td>
<td>5 mg/m(^3) R</td>
<td></td>
</tr>
</tbody>
</table>

3. Sulfate Salt  
<table>
<thead>
<tr>
<th></th>
<th>4 mg/m(^3) Inhalable</th>
<th>1.5 mg/m(^3) R</th>
<th>10 mg/m(^3)</th>
<th>15 mg/m(^3) Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 mg/m(^3) Inhalable</td>
<td>3 mg/m(^3) R</td>
<td>5 mg/m(^3) R</td>
<td></td>
</tr>
</tbody>
</table>

**Notations:**  
IOELVs = Indicative Occupational Exposure Limit Values  
OEL = Occupational Exposure Limits  
TLV = Threshold Limit Value  
R = Respirable  
TWA = time weighted average  
PEL = Permissible Exposure Limit  
STEL = Short Term Exposure Limit

**Exposure Controls:**

**Ventilation Controls:**

Use mechanical ventilation to prevent dust generation, if necessary.

**Respiratory Protection:**

Respirators are generally not needed under normal conditions of use. If dust levels exceed the exposure limits use an NIOSH-approved dust respirator (N95 or better). The actual workplace exposure to dust and crystalline silica should be determined by workplace exposure testing if the final product is sanded, ground, or pulverized. If there is exposure to respirable silica over workplace limits, an N100 respirator filter should be used along with proper engineering controls. In Europe, the respirator must be CE-marked and filter FFP3 is for high efficiency.

**Protective Gloves:**

Avoid skin contact by use of neoprene, butyl, PVC-coated or like type chemical resistant gloves for dust exposure.

**Eye Protection:**

Safety goggles for dust are recommended during powder additions and cleaning.

**Skin Protection:**

Special skin protection is not routinely needed when using the product. If clothing becomes contaminated wash contaminated clothing before reuse.

**Other Controls:**

Safety shower and eyewash. Wash contaminated clothing before reuse. Always use good personal hygiene and housekeeping practices to minimize dust exposures. Wash thoroughly after handling.

**Environmental Exposure Controls:**

This product is not known to contain chemical components requiring specific environmental exposure controls. Specific environmental requirements, however do vary and each user needs to follow local Community environmental protection requirements.

### Section 9. Physical & Chemical Properties

**Appearance:** Powder

**Boiling Point (F°):** Not applicable (NA)

**Vapor Pressure (MM Hg):** NA

**Color:** White/Off-White Powder

**Odour:** Slight odour

**Clarity:** NA

**VOC by Weight** = 0% (EPA Method 24)

**Spec Gravity** \((H_2O = 1): 1.3 - 3.0\)

**pH:** 4 - 8 (aqueous solution)

\[^2\] There is <0.1% respirable crystalline silica, no exceedance of OSHA/TLV anticipated.
Melting Point: NA
Flash Point: NA
Flammability (solid, gas): Noncombustible
Explosive Properties: NA
Oxidizing Properties: NA
Bulk Density: 1.5 g/cc
Water/Oil Distribution: NA
Solubility: 0.67 to 0.88 g/100 g solution
Solubility Fat: NA
Evaporation Rate: NA
Partition coefficient: n octanol/water: NA
Density: Not known
Viscosity: Not Determined

Section 10. Stability and Reactivity

Stability: Stable in dry environments. Dew point conditions or other conditions causing presence of liquid will harden the material.

Conditions to Avoid: Avoid wet / high humidity conditions.

Materials to Avoid: Incompatible: Acids, strong oxidizing agents, phosphorous, water, high humidity.

Hazardous Decomposition Products: Aldehydes, carbon monoxide, carbon dioxide, sulfur oxides, and aluminum oxide. Temperatures above 1,450°C calcium oxide and sulfur dioxide. Irritating and toxic fumes at elevated temperatures.

Hazardous Polymerization: Will not occur.

Section 11. Toxicological Information

Data for product components only, mixture not evaluated.

<table>
<thead>
<tr>
<th>1. Plaster</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human</strong></td>
<td>Oral LD50 - &gt;5,000 mg/kg: Skin LD50 - not determined: Eye Irritation - not determined: Dermal LD50 - not determined. The sulfate ion has caused gastro-intestinal disturbance in humans following large oral doses. Plaster has &lt;1% Crystalline Silica as total weight and exposures to any hazardous levels of respirable silica are not anticipated. The following information is based on silica toxicology information not the hazard of this product. Crystalline silica: Prolonged and repeated exposure to airborne free respirable crystalline silica can result in lung disease (i.e., silicosis) and/or lung cancer. The development of silicosis may increase the risks of additional health effects. The risk of developing silicosis is dependent upon the exposure intensity and duration. In June, 1997, IARC classified crystalline silica (quartz and cristobalite) as a human carcinogen. In making the overall evaluation, the IARC Working Group noted that carcinogenicity in humans was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs. IARC states that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1).</td>
</tr>
<tr>
<td><strong>Monkeys, Rats, Hamsters</strong></td>
<td>Limited studies involving the repeated inhalation of an (unspecified) calcium sulfate failed to identify any particular target organs in monkeys, rats and hamsters.</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>Ames bacterial Test - no mutagenicity</td>
</tr>
<tr>
<td>2. Vinyl Polymer</td>
<td></td>
</tr>
<tr>
<td><strong>Human</strong></td>
<td>Eye Irritation - Severe: Skin Irritant - Mild</td>
</tr>
<tr>
<td><strong>Rabbit</strong></td>
<td>Skin LD50 - 7,490 mg/kg</td>
</tr>
<tr>
<td><strong>Rat</strong></td>
<td>Oral LD50 - 23,854 mg/kg: Inhalation LC50 - 64,000 ppm/4 hr</td>
</tr>
<tr>
<td><strong>Mouse</strong></td>
<td>Oral LD50 - 14,270 mg/kg</td>
</tr>
<tr>
<td><strong>Adult Guinea Pig</strong></td>
<td>Oral LD50 - 18,750 mg/kg</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>IARC Cancer Review: Group 3 IMEMDT 7,56,87; Animal Limited Evidence IMEMDT 19,341,79; Human Inadequate Evidence IMEMDT 19,341,79.</td>
</tr>
<tr>
<td>3. Sulfate Salt</td>
<td></td>
</tr>
<tr>
<td><strong>Human</strong></td>
<td>Oral Woman LDLo - 750 mg/kg; behavioral – convulsions or effect on seizure threshold, lungs, thorax, or respiration; other changes, gastrointestinal, hypermotility, diarrhea</td>
</tr>
<tr>
<td><strong>Rat</strong></td>
<td>Oral LD50 - 6,600 mg/kg</td>
</tr>
</tbody>
</table>

Section 12. Ecological Information

Data for product components only, mixture not evaluated.

| 1. Plaster | No data available |
| 2. Vinyl Polymer |  |
| **Aquatic Toxicity** | Test: LC50 Fish Species: Bluegill Sunfish Test: LC50 Fish Species: Fathead Minnow Test: LC50 Daphnia Species: Cerio Daphnia Test: LC50 Daphnia Species: Daphnia magna |
Bioaccumulation
Value: >10,000 mg/L
Time: 96 hr

Biodegradability
Biodegradability >90 (Zahn-Wellens test)

Biological Oxygen Demand (BOD): BOD5 = 0-5%; BOD30 = 100%
Chemical Oxygen Demand (COD): 1,800 mg/L

Other Adverse Effects
No data available

Aquatic Toxicity
Species: Alburnus Microlepis
Value: 2,380,000 ug/L
Time: 96 hr

Aquatic Toxicity
Species: Leopomis Macrochirus
Value: 869 mg/L
Time: 96 hr

Section 13. Disposal Considerations

Follow disposal procedures in accordance with federal, state and local regulations or applicable national or regional provisions.

Section 14. Transportation Information

Non-regulated material.

Section 15. Regulatory Information

The following provides a summary of the legal requirements.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>EPA TSCA</th>
<th>CA Prop 65</th>
<th>European Economic Community (EEC)</th>
<th>Canada Regs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EINECS</td>
<td>European Community Standards</td>
<td>Listed as dangerous chemicals</td>
<td>EEC Symbol</td>
</tr>
<tr>
<td></td>
<td>DSL</td>
<td></td>
<td></td>
<td>DSL</td>
</tr>
<tr>
<td>(1) Plaster</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>S2</td>
<td>Nuisance dust 10 mg/m³</td>
<td>No</td>
<td>S22</td>
</tr>
<tr>
<td>(2) Vinyl</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>S24/25</td>
</tr>
<tr>
<td>Polymer</td>
<td></td>
<td>Nuisance dust 10 mg/m³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Sulfate</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>S22</td>
</tr>
<tr>
<td>Salt</td>
<td></td>
<td>Nuisance dust 10 mg/m³</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DSL = Canadian Domestic Substance List
NPRI = National Pollutant Release Inventory

Relevant Risk and Safety Phrases for the Mixture:

Safety Phrases:
S2: Keep out of reach of children
S7: Keep container tightly closed
S22: Do not breathe dust
S24/25: Avoid contact with skin and eyes
S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S36/37: Wear suitable personal protective equipment and gloves
S51: Use only in well ventilated areas

Pursuant to Title III of the Superfund Amendments and Reauthorization Act of 1986, (SARA) and 40 CFR 372 Part 372, this product does not contain any chemicals subject to the reporting requirements under Section 313.
This product does not contain chemicals subject to the reporting requirements under the Canadian National Pollutant Release Inventory (NPRI).

California Proposition 65: This product contains trace amounts of crystalline silica in raw product which are known to the state of California to cause cancer.

Section 16. Other Information

HMIS (Hazardous Materials Information System) for secondary labeling:

- Health 1*
- Fire Hazard 0
- Reactivity 1
- Personal Protective Equipment B

*additional chronic hazards present

Revised: The reason for this revision was to update the combustibility data.

References

1) 2006 Threshold Limit Values and Biological Exposure Indices. American Conference of Governmental Industrial Hygienists.
2) Chemical (Hazard Information and Packaging for Supply) Regulation 2002 (UK)
3) MSDS + Cheminfo (2005-1) CD-ROM expires 6/05, Canadian Centre for Occupational Health and Safety
4) SAX'S Dangerous Properties of Industrial Materials, Tenth Edition
5) ESIS: European Chemical Substance Information System, http://ecb.jrc.it/esis
6) TSCA & SARA Title III, CD-ROM, January 2005 Version 9.2 Produced by the U.S. Environmental Protection Agency and the National Technical Information Services
7) Raw Material Manufacturers Material Safety Data Sheets
8) US National Institute of Medicine/Toxnet current 2005
9) NOHSC Hazardous Information Substances Information System, Department of Employment and Workplace Relations, Australian Government, 2005

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