MATERIAL SAFETY DATA SHEET


NON-HAZARDOUS SUBSTANCE.
NON-DANGEROUS GOODS.
Hazard classification according to the criteria of NOHSC.
Dangerous goods classification according to the Australia Dangerous Goods Code.

Section 1 Identification of Chemical Substance and Company

1.1 PRODUCTS IDENTIFICATION: zp®100 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: 781-852-5050
Foreign Contact: +(45) 48 14 11 22
Svanevang 2, 3450 Allerød, Denmark
Date of Preparation: 6/99 Revised: 12/00, 9/03, 7/04, 7/10

1.4. FOR CHEMICAL EMERGENCY: Spill Leak Fire Exposure or Accident
Call CHEMTREC Day or Night
DOMESTIC NORTH AMERICAN: 800-424-9300
INTERNATIONAL, CALL 703-527-3887 (collect calls accepted)

Section 2 Hazard Information

Potential Human Health Effects:
Direct contact with product may cause eye, nose, or skin irritation. Prolonged or repeated inhalation of dust may cause nasal and respiratory tract irritation, coughing, sneezing or watering eyes.

Target Organs or Systems:
Eyes, skin and respiratory system

Routes of Exposure:
Inhalation, skin absorption, eye contact, ingestion

Signs and Symptoms of Exposure:
Eyes, skin, nose, throat, and lung irritant. Contact may dry skin and can be harmful if absorbed through the skin. Ingestion can cause gastrointestinal disturbances. Harmful if swallowed.

Acute Effect:
May cause irritation of the eyes, mucous membranes, and respiratory tract. May be harmful by inhalation or ingestion. 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 the heat could cause severe burns that may require medical attention. Eye contact may cause mechanical abrasion with burning, tearing and redness. Ingestion may cause gastrointestinal disturbances such as upset stomach and intestinal irritation.

Chronic:
Prolonged overexposure to any nuisance dust may cause lung injury and/or skin irritation. Symptoms include cough, shortness of breath, and reduced pulmonary function. Chronic overexposure may cause lung damage. This 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; however, prolonged and repeated respirable silica overexposures can result in lung disease (i.e. silicosis) and/or lung cancer. If the final castings 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.

**Eyes:** No known chronic effects

**Ingestion:** No known effects

**Medical Conditions Possibly Aggravated by Exposure:**
Inhalation of product may aggravate existing chronic respiratory problems such as asthma, emphysema, or bronchitis

**Carcinogens Under OSHA, ACGIH, NTP, IARC, OTHER:**
This product contains < 1% by weight of crystalline silica and there is < 0.1% respirable crystalline silica. Only the respirable fraction of crystalline is specifically regulated by OSHA. 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.

**Potential Environmental Effects:**
No significant environmental hazard are expected if material is released to the environment.

**Section 3 Composition/Information on Ingredients**

Substance is a mixture with following general composition:

<table>
<thead>
<tr>
<th>Component</th>
<th>Approx. %</th>
<th>C.A.S. No. &amp; EINECS No.</th>
<th>UK/EU Classification according to Directive 67/548/EEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Plaster which contains Crystalline Silica&lt;sup&gt;1&lt;/sup&gt;</td>
<td>50%-80%</td>
<td>Trade Secret</td>
<td>None</td>
</tr>
<tr>
<td>2. Vinyl Polymer</td>
<td>5%-25%</td>
<td>Trade Secret</td>
<td>None</td>
</tr>
<tr>
<td>3. Carbohydrate</td>
<td>5%-25%</td>
<td>Trade Secret</td>
<td>None</td>
</tr>
</tbody>
</table>

**Section 4 Emergency First Aid**

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

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

**Skin Contact Exposure:**
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.

**Oral Exposure (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.

<sup>1</sup> There is <0.1% respirable crystalline silica, no anticipated OSHA/TLV overexposure expected.
Section 5 Fire and Explosion Hazard

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

Product is a combustible powder:
Minimum Ignition Energy (ASTM E 2019): 5kJ <MIE <10kJ
Dust Cloud Minimum Explosible Concentration (ASTM E 1515): N/A
Dust Explosivity (ASTM E 1226): $P_{\text{max}} = 4.7$ bar-g, $R_{\text{max}} = 37$ bar/s, $K_{\text{st}} = 10$ bar-m/s, and $\text{Class} = \text{St.1}$

Extinguishing Media:
Water spray 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. Fine dusts with oxygen can be explosive – keep away from open flame.

Section 6 Accidental Release Measures

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

Environmental Precautions:
Avoid contamination of ground and surface waters. 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 which produce high levels of dust. Use mechanical ventilation to prevent dust generation. If dust collection systems are used they may need to be provided with explosion venting and automatic fire protection as recommended in NFPA 68-1994 Guidie for Explosion Venting.

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/m$^3$. Particulates not otherwise classified (total dust) in Germany are 6 mg/ m$^3$, and 10 mg/m$^3$ in other European Countries. The respirable dust levels are 5 mg/ m$^3$.

<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>(1) Plaster</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crystalline Silica$^2$</td>
<td>6 mg/m$^3$ R</td>
<td>0.3 mg/m$^3$ total 0.1 mg/m$^3$ R</td>
<td>10 mg/m$^3$ Inhalable 3 mg/m$^3$ R</td>
<td>15 mg/m$^3$ Total 5 mg/m$^3$ R</td>
</tr>
<tr>
<td>(2) Vinyl Polymer</td>
<td>General Dust</td>
<td>4 mg/m$^3$ I 1.5 mg/ m$^3$ R</td>
<td>10 mg/m$^3$</td>
<td>10 mg/m$^3$ Inhalable 3 mg/m$^3$ R</td>
</tr>
<tr>
<td>(3) Carbohydrate</td>
<td>General Dust</td>
<td>4 mg/ m$^3$ I 1.5 mg/ m$^3$ R</td>
<td>10 mg/m$^3$</td>
<td>10 mg/m$^3$ Inhalable 3 mg/m$^3$ R</td>
</tr>
</tbody>
</table>

**Notations:**
- IOELVs = Indicative Occupational Exposure Limit Values
- OEL = Occupational Exposure Limits
- TLV = Threshold Limit Value
- PEL = Permissible Exposure Limit
- R = Respirable
- I = Inhalable

**Ventilation Controls:**
Mechanical ventilation needs to be adequate to handle low levels of dust when adding product or there is a spill.

**Respiratory Protection:**
Respirators are generally not needed under normal conditions of use. If dust levels exceed the exposure limits use an approved dust respirator of at least an N95 (NIOSH) approval. 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 testing. If there are overexposures to respirable silica a 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 chemical components requiring specific environmental exposure controls. Specific environmental requirements, however do vary and each user needs to follow local Community environmental protection requirements.

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$^2$ There is <0.1% respirable crystalline silica, thus no overexposure to OSHA/TLV levels are anticipated.

$^3$ OSHA standard assuming 100% of the dust sample is respirable silica
Section 9 Physical & Chemical Properties

Appearance: Powder  
Boiling Point (F°): NA  
Vapor Pressure (MM Hg): Not Applicable (NA)  
Vapor Density (air = 1): NA  
pH: 4 - 8 (aqueous solution)  
Melting Point: Not Determined (ND)  
Flash Point: NA  
Flammability (solid, gas): Combustible Dust  
Explosive Properties: NA  
Oxidizing Properties: NA  
Bulk Density: ND  
VOC by Weight = 0% (EPA Method 24)  
Spec Gravity (H₂O = 1): 1.3 - 3.0  
Color: White/Off-White Powder  
Odour: Slight odor  
Clarity: NA  
Solubility: ND  
Solubility Fat: NA  
Evaporation Rate: NA  
Partition coefficient: n octanol/water: NA  
Density: ND  
Viscosity: ND

Section 10 Stability and Reactivity

Stability:  
Stable: Stable in dry environments. Dew point conditions or other conditions causing presence of liquid will harden the material.  
Conditions to Avoid: Store in cool place  
Materials to Avoid: Incompatible: Acids, strong oxidizing agents. Acids contact will cause vigorous reaction resulting in production of large amounts of heat.

Hazardous Polymerization: Will not occur

Section 11 Toxicological Information

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated for the mixture. The following is for the product components.

<table>
<thead>
<tr>
<th>1. Plaster</th>
</tr>
</thead>
<tbody>
<tr>
<td>The sulfate ion has caused gastro-intestinal disturbance in humans following large oral doses. Limited studies involving the repeated inhalation of an (unspecified) calcium sulfate failed to identify any particular target organs in monkeys, rats and hamsters. No evidence of mutagenicity was found in Ames bacterial tests.</td>
</tr>
</tbody>
</table>

| Rat | Oral LD50 >5000 mg/kg |
|----------------|
| Dermal LD50 – None Determined |
| Skin Irritation LD50 – None Determined |
| Eye Irritation LD50 – None Determined |
Plaster has <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).

### 2. Vinyl Polymer

<table>
<thead>
<tr>
<th>Rat</th>
<th>Oral LD50: 23,854 mg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation LC50</td>
<td>64,000 ppm/4 hr.</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Dermal LD50: &gt;7,490 mg/kg</td>
</tr>
<tr>
<td>Mouse</td>
<td>Oral LD50: 14,270 mg/kg</td>
</tr>
<tr>
<td>Guinea Pig</td>
<td>Oral LD50: 18,750 mg/kg</td>
</tr>
</tbody>
</table>

IARC Cancer Review: Group 3 IMEMDT 7,56,87; Animal Limited Evidence IMEMDT 19,341,79; Human Inadequate Evidence IMEMDT 19,341,79. All other ingredients not listed by NTP, IARC, or OSHA as probable or possible human carcinogens.

### 3. Carbohydrate

<table>
<thead>
<tr>
<th>Human</th>
<th>Skin: 300 ug/3D-I Mild irritation effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Intrapertoneal LD50: 6600 mg/kg</td>
</tr>
</tbody>
</table>

## Section 12 Ecological Information

As with all foreign substances, do not allow to enter the storm drainage systems. There is no information based on the preparation and limited data in terms of ecotoxicity and the other factors. The only ecological data available is on (2) Vinyl Polymer.

### 1. Plaster

| No data |

### 2. Vinyl Polymer

| Bluegill sunfish (Lepomis macrochirus) LC50: >10,000 mg/L 96 hour |
| Cerio Daphnia LC50: 7.9 g/L 48 hour |
| Fathead Minnows LC50: >40 g/L 96 hour |
| Daphnia magna LC50: 8300 mg/L 96 hour |
| Mobility Chemical oxygen demand (COD): 1800 mg/g |
| Persistence and degradability Biochemical oxygen demand: BOD5 = 0-5%; BOD30 = 100% |
| Bioaccumulation potential Biodegradability: >90% (Zahn-Wellens Test) |

### 3. Carbohydrate

| No data |

## Section 13 Waste Disposal

Follow safe solid waste disposal guidelines in accordance with governmental regulations (community, national or regional). Contact a licensed professional waste disposal service to dispose of this mixture. As with all foreign substances do not allow to enter the storm drainage systems. Material may be dissolved or mixed with a combustible solvent and burned in a chemical incinerator equipped with an afterburner and scrubber if approved by the governmental authority.
Section 14 Transportation Information

This is not a regulated material for transportation.

Section 15 Regulatory Information

The following table summarizes reporting.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>EPA TSCA</th>
<th>European Economic Community (EEC)</th>
<th>Listed as dangerous chemicals per ESIS</th>
<th>Canada Regs</th>
<th>DSL</th>
<th>IDL Item #</th>
<th>WHMIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Plaster (silica)</td>
<td>Yes</td>
<td>Yes</td>
<td>Nuisance dust 6 to 10 mg/m³</td>
<td>No</td>
<td>None</td>
<td>Yes</td>
<td>1406 D2A</td>
</tr>
<tr>
<td>2. Vinyl Polymer</td>
<td>Yes</td>
<td>Yes</td>
<td>Nuisance dust 6 to 10 mg/m³</td>
<td>No</td>
<td>None</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3. Carbohydrate</td>
<td>Yes</td>
<td>Yes</td>
<td>Nuisance dust 6 to 10 mg/m³</td>
<td>No</td>
<td>None</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

DSL = Canadian Domestic Substance List
IDL# = Canadian Hazardous Products Act – Ingredient Disclosure List Item #

Relevant European R and S phrases:

**Risk Phases:**
R36/37/38: Irritating to the eyes, respiratory system, and skin.

**Safety Phases:**
S2: Keep out of reach of children
S7: Keep container tightly closed
S24/25: Avoid contact with skin and eyes.
S36: Wear suitable personal protective equipment.

Pursuant to Title III of the Superfund Amendments and Reauthorization Act of 1986, (SARA) and 40 CFR 372 Part 372, this product does 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 1
- Reactivity 1
- Personal Protective Equipment B

Reason for Revision: To conform with Australian regulations, update ingredient list and format.
References

1) 2010 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 (Canadian Centre for Occupational Health and Safety.
4) SAX’S Dangerous Properties of Industrial Materials
5) European Commission Joint Research; EINECS, ESIS, ELINCS
6) TSCA & SARA Title III, CD-ROM, January 2004 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 Medicines Toxnet current versions.

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