

MATERIAL SAFETY DATA SHEET

Complies with Approved Code of Practice: Chemical (Hazard Information and Packaging for Supply) Regulations 2002 (UK) and European 91/155/EEC, 67/548/EEC, 1999/45/EC format, and 2001/58/E, ANSI Standard Z400.1 and U.S. Federal OSHA Hazard Communication

Section 1 Identification of the Substance/Preparation and Company

- 1.1 **PRODUCTS IDENTIFICATION:** zp™ 102 powder
- 1.2 **USE OF SUBSTANCE:** Plaster powder for making rapid-prototyping 3D models.
- 1.3 **COMPANY:**

Z Corporation
20 North Ave.
Burlington, MA 01803
Contact Person: Manager of Technical Services
Telephone Number: 781-852-5005

UK Contact:
Z Corporation UK Ltd.
Roslyn Works
36 Uttoxeter
Longton
Stoke-On-Trent
ST3 1PQ
+44(0)870 241 6502

Date of Preparation: 7/03 Revised: 9/04

- 1.4 **EMERGENCY TELEPHONE:** 781-852-5005

Section 2 Composition/Information of Ingredients

Substance is a mixture with following general composition:

Component Classified As Dangerous (CHIP3)	Approximate % by weight	C.A.S. No. & EINECS No.	UK/EU Classification
(1) Plaster which contains Crystalline Silica ¹	<60% <1% by weight of plaster	Trade Secret	Irritant Xi R 36/37/38
(2) Vinyl Polymer	5 - 30%	Trade Secret	Irritant Xi R 36/37/38
(3) Carbohydrate	5 - 30%	Trade Secret	Irritant Xi R 36/37/38
(4) Glass Beads	5 - 30%	Trade Secret	Irritant Xi R 36/37/38

¹ There is <0.1% respirable crystalline silica, no anticipated OSHA/TLV overexposure expected.

Section 3 Hazards Identifications

This product is a preparation and the components are not classified in the Annex I of Directive 67/548/EEC nor are any of the substances listed in a priority list under EEC No. 793/93

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 exposure to any nuisance dust may cause lung injury and/or skin irritation. Symptoms include cough, shortness of breath, and reduced pulmonary function. Chronic exposure 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 exposures 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. 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 silica 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 4 Emergency First Aid Measures

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.

Section 5 Fire-Fighting Measures (Fire and Explosion Hazard)

Flash point (Method Used)

Not Applicable

Flammable limits (LEL and UEL)

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): $P_{max} = 4.7$ bar-g, $R_{max} = 37$ bar/s, $K_{st} = 10$ bar-m/s, and $Class = St.1$

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. This material in contact with water may create a slippery walking surface.

Unusual Fire & Explosion:

Emits toxic fumes under fire conditions. Fine dusts with oxygen can be explosive – keep away from open flame.

Exposure Hazard(s): Material: Irritant

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. If vacuum is used to collect dust, use an industrial vacuum cleaner with a high efficiency air filter maintained to the manufacturer's requirements. Do not flush down drains. Place in closed containers. Ventilate area and wash spill site after material pickup is complete

Waste Disposal Method: See Section 13.

Section 7 Handling and Storage**Handling Precautions:**

User Exposure: Under planned use this product should not result in excessive dust or hazards to the user following the recommended processes for creating prototype models. Avoid handling procedures which produce high levels of dust. If user operations generate dust, such as may occur from dispensing product from bags or containers, use local exhaust ventilation to keep exposure to airborne dusts below the exposure limit.

Storage Precautions:

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:

If dust collection systems are used they should be selected so as to be compatible with plaster based powders, and consistent with the most recent edition of NFPA 654 Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids.

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, and 10 mg/m³ in other European Countries. The respirable dust levels are 5 mg/m³.

Component	IOELVs (UK)	EC OEL	ACGIH TLV	OSHA PEL
(1) Plaster	6 mg/m ³ R	10 mg/m ³	10 mg/m ³ Inhalable	15 mg/m ³ Total
Crystalline Silica ²	0.3 mg/m ³ total 0.1 mg/m ³ R		3 mg/m ³ R 0.05 mg/m ³ R Silica	5 mg/m ³ R 0.1 mg/m ³ Respirable ³
(2) Vinyl Polymer	General Dust 4 mg/m ³ I 1.5 mg/m ³ R	10 mg/m ³	10 mg/m ³ Inhalable 3 mg/m ³ R	15 mg/m ³ Total 5 mg/m ³ R
(3) Carbohydrate	General Dust 4 mg/m ³ I 1.5 mg/m ³ R	10 mg/m ³	10 mg/m ³ Inhalable 3 mg/m ³ R	15 mg/m ³ Total 5 mg/m ³ R
(4) Glass Beads	General Dust 4 mg/m ³ I 1.5 mg/3 R	10 mg/m ³	10 mg/m ³ Inhalable 3 mg/m ³ R	15 mg/m ³ Total 5 mg/m ³ R

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

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

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 exposures 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 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	VOC by Weight = 0% (EPA Method 24)
Boiling Point (F°): NA	Spec Gravity (H ₂ O = 1): 1.3 - 3.0
Vapor Pressure (MM Hg): Not applicable (NA)	Color: White/Off-White Powder
Vapor Density (air = 1): NA	Odour: Slight odor
pH: 4 - 8 (aqueous solution)	Clarity: NA
Melting Point: Minimum 1450° C	Solubility: 0.67 to 0.88 g/100 g solution
Flash Point: NA	Solubility Fat: NA
Flammability (solid, gas): Combustible Dust	Evaporation Rate: NA
Explosive Properties: NA	Partition coefficient: n octanol/water: NA
Oxidizing Properties: NA	Density: Not known
Bulk Density: NA	Viscosity: Not Determined
Water/Oil Distribution: NA	

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, bases, aluminum, copper, zinc, water, high humidity. Acids contact will cause vigorous reaction resulting in production of large amounts of heat.

Hazardous Decomposition Products: Aldehydes, carbon monoxide, carbon dioxide, sulfur oxides, and aluminum oxide. Temperatures above 1450°C calcium oxide and sulfur dioxide. Irritating and toxic fumes at elevated temperatures.

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.

Plaster (1):

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.

Oral LD50 rate > 5000 mg/kg

Dermal LD50 – nNone 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).

Vinyl Polymer (2):

Acute Toxicity Effects Data: Oral LD50 (rat) 23,854 mg/kg

Dermal LD50 (rabbit): >7,490 mg/kg,

Inhalation LC50 (rat): 64,000 ppm/4 hr.

Oral-Mouse LD50: 14,270 mg/kg

Oral-Guinea Pig, adult LD50: 18,750 mg/kg

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.

Carbohydrate (3):

Skin-Human 300 ug/3D-I Mild irritation effects
 Intraperitoneal-Mouse LD50: 6600 mg/kg

Section 12 Ecological Information**Ecotoxicity Vinyl Polymer (2):**

LC50 Bluegill sunfish (*Lepomis macrochirus*): >10,000 mg/L 96 hour
 LC50 Cerio Daphnia: 7.9 g/L 48 hour
 LC50 Fathead Minnows: >40 g/L 96 hour
 LC50 Daphnia magna: 8300 mg/L 96 hour

Mobility: Vinyl Polymer (2): Chemical oxygen demand (COD): 1800 mg/g

Persistence and degradability Vinyl Polymer (2):

Biochemical oxygen demand: BOD5 = 0-5%; BOD30 = 100%

Bioaccumulation potential: Vinyl Polymer (2) Biodegradability: >90% (Zahn-Wellens Test)

Other adverse effects: No other data available to address these issues.

Section 13 Disposal Considerations

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.

Ingredient	EPA TSCA	European Economic Community (EEC)				Canada Regs	
		EINECS	European Community Standards	Listed as dangerous chemicals ⁴	EEC Symbol	DSL	NPRI
(1) Plaster (silica)	Yes	Yes	Nuisance dust 6 to 10 mg/m ³	R 36/37/38 S2/7/24/25/26/36	None	Yes	1406
(2) Vinyl Polymer	Yes	Yes	Nuisance dust 6 to 10 mg/m ³	R 36/37/38 S2/7/24/25/26/36	None	Yes	No
(3) Carbohydrate	Yes	Yes	Nuisance dust 6 to 10 mg/m ³	R 36/37/38 S2/7/24/25/26/36	None	Yes	No
(4) Glass Beads	Yes	Yes	Nuisance dust 6 to 10 mg/m ³	R 36/37/38 S2/7/24/25/26/36	None	Yes	No

⁴ None of the substances except for silica are classified in Annex I of EEC Directive 67/548, the R and S phases are based on general associated hazards.

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

Relevant European R and S phrases: Irritant Mixture Xi

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.

S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

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 UK CHIP 3 and EPA Method 24

References

- 1) 2004 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 (2001-1) CD-ROM expires 6/04, Canadian Centre for Occupational Health and Safety.
- 4) SAX'S Dangerous Properties of Industrial Materials, Tenth Edition.
- 5) EINECS Plus CD-ROM Version 2004:1, SilverPlatter Information, Health and Safety Publishing.
- 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 2004.

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