MATERIAL SAFETY DATA SHEET

Zircopax A
TAM Product ID 51445

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification
TAM Ceramics Product Identification Number: 51445

Tradenames and Synonyms
ZIRCONIUM SILICATE
ZIRCON
CERAMIC OPACIFIER

Company Identification
MANUFACTURER
TAM CERAMICS, INC.
4511 Hyde Park Blvd.
Niagara Falls, NY 14305-0067

DISTRIBUTOR
COOKSON-MATTHEY Zircon Americas
4511 Hyde Park Blvd.
Niagara Falls, NY 14305-0067

PHONE NUMBERS
Product Information 1-716-278-9400
Transport Emergency CHEMTREC: 1-800-424-9300
Safety/Health Information 1-716-278-9423

Cookson
COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZIRCON</td>
<td>14940-68-2</td>
<td>95</td>
</tr>
<tr>
<td>KYANITE</td>
<td>1302-76-7</td>
<td>0.3</td>
</tr>
<tr>
<td>STAUROLITE</td>
<td>12182-56-8</td>
<td>4</td>
</tr>
<tr>
<td>QUARTZ</td>
<td>14808-60-7</td>
<td>&lt;0.5</td>
</tr>
</tbody>
</table>

HAZARDS IDENTIFICATION

Potential Health Effects
The product, as shipped, does not pose an inhalation health hazard because it contains essentially no particles in the respirable size range. However, if during handling or use the particles are broken down to a size that can be inhaled, the dusts may be harmful to the respiratory system. This product contains trace quantities (90-110 pCi/g) of naturally occurring radioactive uranium and thorium (less than or equal to 420 ppm total uranium and thorium or 0.042% w/w), and (109-114 pCi/g) radium. Overexposure by inhalation to respirable dusts containing radioactive uranium, thorium, and radium may cause lung cancer. Eye contact with the product may cause irritation with discomfort, tearing, or blurring of vision.

The predominant effect of overexposure to airborne respirable quartz in humans is silicosis. Silicosis is a chronic fibrotic lung disease characterized by formation of silica containing scar tissue in the lungs with symptoms of coughing, dyspnea, wheezing, and nonspecific respiratory ailments. Gross acute overexposures to quartz by inhalation may cause fatality. Epidemiological studies show that, in addition to silicosis, there is limited evidence of excess lung cancer in occupations involving exposures mainly to respirable quartz, such as stone cutters and granite industry workers.

Individuals with preexisting conditions of the lungs may have increased susceptibility to the toxicity of excessive exposures.

Observance of the 5 mg/m³ OSHA PEL for respirable dust will ensure that use of this product is within limits established for exposure to respirable quartz and to naturally occurring radioactive uranium, thorium, and radium.

Zircon is exempt from NRC regulations for source material per 10 CFR 40, since it falls under the definition of unprocessed material containing less than 0.05%
uranium or thorium. However, observance of 2.2 - 2.8 mg/m³ of respirable dust will under voluntary guidelines ensure that intake is less than 10% of the Annual Limits on Intake (ALIs) specified in 10 CFR 20.1502(b) and NRC Standards for Protection Against Radiation for uranium, thorium, radium, and radioactive daughter decay products.

**Target Organs**
None reported.

**Primary Entry Route**
This product can enter the body by ingestion or inhalation.

**Carcinogenicity Information**
The following components are listed by IARC, NTP, OSHA, or ACGIH as carcinogens. A “P” indicates a proposed carcinogen.

<table>
<thead>
<tr>
<th>Material</th>
<th>IARC</th>
<th>NTP</th>
<th>OSHA</th>
<th>ACGIH</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUARTZ</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**FIRST AID MEASURES**

**Inhalation**
If inhaled, immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

**Skin Contact**
The compound is not hazardous by skin contact, but removal of particles and cleansing of the skin after use is advisable.

**FIRE FIGHTING MEASURES**

**Flammable Properties**
Will not burn.

**Extinguishing Media**
As appropriate for combustibles in area.

**Fire Fighting Instructions**
None.
ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)
NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Accidental Release Measures
Sweep up spillage. Avoid creation of respirable airborne dust.

HANDLING AND STORAGE

Handling (Personnel)
Avoid breathing dust. Wash thoroughly after handling. If handling respirable flour, use of gloves and washing before eating, drinking, applying cosmetics, or smoking is advisable to minimize dust inhalation from hands.

Storage
Store this product in closed containers. Protect containers from physical damage.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls
Use sufficient ventilation to keep employee exposure below recommended limits. When using this product as an abrasive blast agent in confined areas, airborne dust levels should be controlled by physical enclosure of the abrasive blasting operation. The enclosure should be exhaust ventilated in accordance with 29 CFR 1910.94 Ventilation (a) Abrasive Blasting.

Personal Protective Equipment
Eye/Face Protection
Wear safety glasses with side shields.

Respirators
A NIOSH/MSHA approved air-purifying respirator with a high efficiency filter approved for radionuclides may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a positive pressure air-supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air-purifying respirators may not provide adequate protection.
OSHA requires a continuous flow air-line supplied respirator with hood for protection in abrasive blasting operations. Refer to OSHA Standards 29 CFR 1910.94.

**Protective Clothing**
Wear impervious clothing, such as gloves, apron, boots, or whole bodysuit as appropriate.

**Exposure Guidelines**
Zirconium silicate products
PEL (OSHA) Particulates (Not Otherwise Regulated)
15 mg/m³, 8 Hr. TWA, total dust
5 mg/m³, 8 Hr. TWA, respirable dust

**Other Applicable Exposure Limits**
**ZIRCON**
PEL (OSHA) 5 mg/m³, 8 Hr. TWA, as Zr
TLV (ACGIH) 5 mg/m³, 8 Hr. TWA, STEL 10 mg/m³, as Zr
Notice of Intended Changes (1995-1996) A4

**QUARTZ**
PEL (OSHA) Total dust, (30 mg/m³ / % Si02 + 2)
Respirable dust, (10 mg/m³ / % Si02 + 2) as 8 Hr. TWA’s
TLV (ACGIH) 0.1 mg/m³, respirable dust, 8 Hr. TWA
Or see: Christobalite [14464-46-1].
Silica, Fused [60676-86-0], Tridymite [15468-32-2], Tripoli [1317-95-9]

**PHYSICAL AND CHEMICAL PROPERTIES**

**Physical Data**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapor Pressure</td>
<td>Not volatile</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>Not volatile</td>
</tr>
<tr>
<td>Melting Point</td>
<td>2,100 C (3,810 F) 2,100 to 2.300 C (3,810 to 4,170 F)</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>(Butyl Acetate = 1)</td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>Insoluble</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Form</td>
<td>Free-flowing finely milled sandy particles</td>
</tr>
<tr>
<td>Color</td>
<td>Off-white</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>4.7</td>
</tr>
</tbody>
</table>

TAM Ceramics MSDS Page 5 ZIRCOPAX A/Product ID 51445
Stability and Reactivity
   Chemical Stability
   Stable.

Incompatibility with Other Materials
   None reasonably foreseeable.

Decomposition
   Decomposition will not occur.

Polymerization
   Polymerization will not occur.

TOXICOLOGICAL INFORMATION

Animal Data
   TAM zirconium silicate products are made from zircon sands which contain low
levels of quartz (up to 0.5%). Effects noted in animals exposed to respirable
quartz by inhalation or intratracheal instillation included pulmonary fibrosis,
inflammation, edema, and emphysema. Lung tumors occurred in rats exposed by
inhalation for up to two years to levels of 12.4 or 51.6 mg/m³ of quartz. Also,
lung tumors were seen in studies in which quartz was instilled in the trachea of
rats. Quartz was positive in mammalian cell cultures for cell transformation and
chromosomal effects and was negative in cell culture assays for gene mutation in
bacteria and DNA damage in mammalian cells and in a whole animal assay for
chromosomal effects.

DISPOSAL CONSIDERATIONS

Waste Disposal
   Treatment, storage, transportation, and disposal must be in accordance with
applicable federal, state, and local regulations. If approved, may be transferred to
a land disposal site.

NOTE:
   Many states have, or are developing, new regulations for disposal of waste
containing Naturally Occurring Radioactive Materials (NORM) above
background levels. Consult and comply with current regulations.

TRANSPORTATION INFORMATION

Shipping Information
   ZIRCON SAND IS NOT REGULATED AS A HAZARDOUS
   MATERIAL BY DOT OR IMO.
Shipping Containers
   Hopper Cars
   Hopper Trucks
   Bags
   Semi-bulk Bags

REGULATORY INFORMATION

U.S. Federal Regulations
TSCA Inventory Status: Reported/Included.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312
   Acute : No
   Chronic : Yes
   Fire : No
   Reactivity : No
   Pressure : No

LISTS:
   SARA Extremely Hazardous Substance - No
   CERCLA Hazardous Material - No
   SARA Toxic Chemical - No

CANADIAN WHMIS CLASSIFICATIONS:
   D-2A; D-2B

"Zircon is exempt from NRC regulations for source material per 10 CFR 40, since it falls under the definition of unprocessed material containing less than 0.05% uranium or thorium."

OTHER INFORMATION

NFPA, NPCA-HMIS
   NPCA-HMIS Rating
   Health 0
   Flammability 0
   Reactivity 0

Personal protection rating to be supplied by user depending on use conditions.
Additional Information

WARNING!

This product contains quartz and radionuclides, both known to the State of California to cause cancer.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process. Component percentages are typical based on historical production performance. TAM Ceramics does not make any expressed or implied warranty that future production will continue to possess these typical properties.

Responsibility for MSDS
TAM Ceramics, Inc.
4511 Hyde Park Blvd.
Niagara Falls, NY 14305-0067

Russ Steiger
Manager of Health, Safety, & Environmental
Telephone (716) 278 -9423
Fax (716) 285-3026

End of MSDS