Material Safety Data Sheet

Section I - Product Information

Manufacturer: APC International, Ltd.
P.O. Box 180, Duck Run Mackeyville, Pennsylvania 17750, USA
Telephone: +1-570-726-6961
Fax: +1-570-726-7466

Chemical Name: Lead Zirconate Titanate; Lead-Titanium-Zirconium-Oxide (Pb(Ti,Zr)O3)
CAS Registry Number: 12626-81-2

Product or Trade Name: PZT; PZT Powder; PZT Ceramics; Piezoceramic Components; Elements; Crystals
Applies to: APC-840; APC-841; APC-850; APC-855; APC-880

Flammibility: 0  Reactivity: 1  Health: 2/3 (ceramic/powder)

Section II - Hazardous Constituents

<table>
<thead>
<tr>
<th>Material/Component</th>
<th>CAS Number</th>
<th>Weight %</th>
<th>OSHA PEL TWA(mg/m3)</th>
<th>ACGIH/TLV TWA(mg/m3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead Oxide</td>
<td>1317-36-8</td>
<td>50-70</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Zirconium Oxide</td>
<td>1314-23-4</td>
<td>10-30</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Titanium Oxide</td>
<td>13463-67-7</td>
<td>5-20</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Niobium Oxide</td>
<td>1313-96-8</td>
<td>0-10</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Strontium Oxide</td>
<td>1314-11-0</td>
<td>0-5</td>
<td>no data available</td>
<td></td>
</tr>
<tr>
<td>Barium Oxide</td>
<td>1304-28-5</td>
<td>0-5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Magnesium Oxide</td>
<td>1309-48-4</td>
<td>0-5</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Nickel Oxide</td>
<td>1313-99-1</td>
<td>0-5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Iron Oxide</td>
<td>1309-37-1</td>
<td>0-5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Manganese Oxide</td>
<td>1313-13-9</td>
<td>0-5</td>
<td>5</td>
<td>0.2</td>
</tr>
<tr>
<td>Silver</td>
<td>7440-22-4</td>
<td>0-25</td>
<td>0.01</td>
<td>0.1</td>
</tr>
</tbody>
</table>

This product is considered a lead compound. Please refer to the Code of Federal Regulations CFR-29-1910.1025 (Lead Standard for industrial workers)
**Section III - Physical Data**

- **Boiling Point (@ S.P.):** n/a
- **Melting Point:** >1350 C
- **Vapor Pressure (mm Hg):** n/a
- **% Volatiles by volume:** n/a
- **Appearance / Odor:** Odorless / Shades of Yellow, Tan, Red, Brown, Green, and Black.

**Bulk Powder Density:** ~ 2.0 g/cc

**Fired Density:** 7.6-8.1 g/cc

**Solubility in water (g/L):** 0.05

**Evaporation Rate:** n/a

**Molecular Weight:** 321.0-332.7

**Section IV - Fire and Explosion Hazard Data**

- **LEL:** n/a
- **UEL:** n/a
- **Flash Point:** n/a
- **Autoignition Temp.:** n/a
- **Extinguishing Media:** Water (Fog or Flood), CO2, Dry Chemical

**Special Fire-fighting Procedures:** Wear full body protective clothing, full face piece and NIOSH or MSHA approved positive pressure self-contained breathing apparatus.

**Unusual Fire/Explosion Hazards:** Fumes, vapor and/or dust may occur and are considered toxic and a respiratory irritant. May react with strong oxidizers.

**Section V - Reactivity Data**

- **Stability:** Powder- Stable to 125 C
  Fired Product - Stable to 800 C

**Incompatibilities:** Strong oxidizers, acids, or bases may produce heat on contact with water or steam.

**Decomposition Products:**
- **Powder -** Temperatures exceeding 125 C will result in decomposition of organic binders which, while non-hazardous, could be considered an irritant and should be adequately exhausted
- **Powder & Ceramics -** Elevated temperatures (>800 C) may produce lead fumes or vapors

**Section VI - Health Hazard Information**

**Routes of Exposure**

- **Inhalation:** Inhalation of dust or fumes may cause respiratory irritation
- **Ingestion:** Resulting from hand to mouth contact or ingestion of dust
- **Skin Contact:** Contact with skin may cause irritation and lead to contact ingestion
- **Skin Absorption:** n/a
- **Eye Contact:** May cause irritation
Effects of Overexposure

Acute Overexposure: Exposure to elevated levels of airborne or ingested lead may produce symptoms of anemia, insomnia, weakness, constipation, nausea, abdominal pain, vomiting, and neuritis. Extreme overexposure may lead to convulsions, stupor, coma and encephalopathy.

Chronic Overexposure: Chronic exposure to airborne and ingested lead may produce symptoms of persistent fatigue, sleep disturbance, headaches, aching bones and muscles, constipation, abdominal pain and loss of appetite. Excessive overexposure may affect the circulatory, nervous, and digestive systems. If chronic exposure is left untreated, neuromuscular dysfunction and possible paralysis may occur. Women of childbearing age should avoid exposure to lead and its inorganic compounds due to the pre-natal effects. Lead can cause potential injury to a developing fetus and have possible effects on reproduction.

Emergency and First Aid Procedures

Inhalation: Remove from area of exposure. Contact physician or Poison Control Center immediately.

Ingestion: Induce vomiting in conscious victim. Contact physician or Poison Control Center immediately.

Skin: Wash thoroughly with soap and water. Use a special soap formulated for use with heavy metals if available.

Eye: Flush eyes with copious quantities of water. Seek immediate medical attention.

Section VII - Personal Protective Equipment (PPE) Recommendations

Respiratory Protection: A NIOSH/MSHA approved dust/fume respirator shall be worn when airborne exposure may exceed OSHA Permissible Exposure Limits (PEL's).

Protective Gloves: Recommended Nitrile gloves for handling powder, not required for handling devices.

Eye Protection: Safety glasses and/or face shield is recommended for protection against exposure to dust.

Protective Clothing: If lead PEL is exceeded, protective clothing should be provided in accordance with OSHA 29-CFR 1910.1025.

Ventilation: Sufficient mechanical ventilation (engineering control, general and or local exhaust) shall be provided to maintain exposure below permissible air concentrations.
Section VIII - Spill or Leak Procedures

In the event of a spill or accidental release:

Avoid inhalation of dust or fumes. Gloves, goggles, and respirators should be worn during clean-up. Small spills should be vacuumed using a HEPA filtered vacuum. Do not dry sweep or use compressed air.

Method of Waste Disposal:

Waste shall be collected, either powder or components, and disposed of in accordance with local, state, and federal regulations. Waste may also, under certain circumstances, be recycled in accordance with local, state and federal regulations.

Neutralizing Materials:

n/a

Section IX - Special Precautions and Hygiene Practices

General Good Hygiene Practices:

Food and drink should not be consumed in areas of use. Tobacco products and cosmetics should not be used in areas of use. Always wash hand thoroughly after handling products, if possible, with a specially formulated soap designed for use with heavy metals. Avoid wearing clothing home from the workplace if handling powders. Store products far away from all foods and feeds.

General Precautions:

Do not reuse containers. Containers may retain product residues, especially if powder. All labeled precautions must be observed. This product is intended for industrial use only. Keep away from children.

General Handling and Storage:

Store product (powder or components) in a dry area. Avoid contact with acids and bases.