

**SECTION 1 - IDENTIFICATION**

**COMPANY ADDRESS:**

The Virtual Foundry, Inc  
211 S Water St  
Stoughton, WI 53589  
USA

PRODUCT NAME: **Zirconium Silicate Filamet™**

PRODUCT USE: Manufacture of metal parts by extrusion, injection-moulding, or 3D printing.

**SECTION 2 - HAZARDS IDENTIFICATION SUMMARY**

(As defined by OSHA Hazard Communication Standard, 29 CFR 1910.1200)

**PHYSICAL HAZARDS:** Contact with product at elevated temperatures can result in thermal burns. Inhalation of dusts and vapors of melted material from this product may cause irritation of the eyes, nose, throat and respiratory system. May cause coughing or shortness of breath. Mechanical eye irritant. May cause tearing and redness. Mechanical skin irritant. Prolonged contact may cause skin abrasion, redness, itching. Irritating to the respiratory tract. Large overdoses may cause nervous system disturbances, and diarrhea. May cause nausea and vomiting. No long-term health effects are anticipated.

**HAZARD STATEMENTS:** Irritating to eyes and respiratory tract. Exposure may include persistent cough, shortness of breath.

**OTHER HAZARDS:** No information available.

**SECTION 3 - COMPOSITION, INFORMATION OF INGREDIENTS**

Ingredient Name	CAS No.	%by Weight
Zirconium Silicate	14940-68-2	60.0
Quartz	14808-60-7	1.0 - 2.0
Aluminum Silicate	1302-76-7	0.0 - 1.5
Chemical Name	CAS No.	%by Weight
2-Propenenitrile, polymer with 1,3-butadiene and ethenylbenzene	9003-56-9	trace
Binding Additive	Proprietary	trace
Polylactic Acid	9051-89-2	<20%

**SECTION 4 - FIRST AID MEASURES**

**IF SWALLOWED:** Induce vomiting immediately as directed by medical personnel.

**IF ON SKIN OR CLOTHING:** Immediately flush with plenty of water for at least 15 minutes. Remove contaminated clothing. Wash skin using soap. Get medical attention if symptoms persist. Cool skin rapidly with cold water after contact with hot polymer. DO NOT attempt to remove hot polymer from skin or contaminated clothing as skin may be easily damaged. If skin irritation persists, call a physician.

**IF IN EYES:** Flush eyes with large volumes of water for at least 15 minutes lifting upper and lower eyelids occasionally. Consult a physician immediately.

**IF INHALED:** Remove from exposure to fresh air. Lay patient down. Cover with blanket. If symptoms persist, call a physician. If person is not breathing, call 911 or an ambulance, then provide medical aid.

**MAIN SYMPTOMS:** Redness, coughing and/or wheezing.

**NOTE TO PHYSICIAN:** Treat symptomatically.

**SECTION 5 - FIRE FIGHTING MEASURES****FLAMMABILITY**

**AUTOIGNITION TEMPERATURE:** 388°C

**FLAMMABILITY LIMITS IN AIR (MEC):** 45g/m<sup>3</sup>

**MEC/MIE:** Refer to NFPA 484, Sec. A4.3.1

**SUITABLE EXTINGUISHING MEDIA:** Foam, carbon dioxide, dry chemical, water.

**UNSUITABLE EXTINGUISHING MEDIA:** No information available.

**SPECIFIC HAZARDS ARISING FROM THE CHEMICAL:** No information available.

**HAZARDOUS COMBUSTION PRODUCTS:** No information available.

**EXPLOSION DATA**

**SENSITIVITY TO MECHANICAL IMPACT:** Not sensitive.

**SENSITIVITY TO STATIC DISCHARGE:** No information available.

**FIRE FIGHTING INSTRUCTIONS AND FIRE FIGHTING EQUIPMENT:** No information available.

**ADDITIONAL INFORMATION:** No information available.

**PERSONAL PROTECTIVE EQUIPMENT:** No information available.

**SECTION 6 - ACCIDENTAL RELEASE MEASURES**

**PERSONAL PRECAUTIONS:** Ensure adequate ventilation. Standard personal protection equipment (PPE). Avoid contact with skin and eyes. Avoid dust formation.

**ENVIRONMENTAL PRECAUTIONS:** Avoid dispersal of spilled material, runoff and contact with soil, waterways, drains, and sewers. Should not be released into the environment, may be dangerous to birds and small animals.

**METHODS FOR CLEANING UP:** Avoid generation of dust cloud during clean-up. Vacuum or carefully scoop up spilled material and place in an appropriate container for disposal. Avoid creating dusty conditions and prevent wind dispersal. Ventilate area through non-mechanical means (e.g., opening a window). Take care not to raise dust. Clean up using methods which avoid dust generation such as vacuuming (with appropriate filter to prevent airborne dust levels which exceed the TLV), wet dust mop or wet clean up. If airborne dust is generated, use an appropriate NIOSH-approved respirator.

**SECTION 7 - HANDLING AND STORAGE**

**HANDLING:** Use personal protective equipment. Workers should be protected from the possibility of contact with molten material during fabrication. Avoid contact with eyes. Low hazard for usual industrial or commercial handling. Avoid accumulations of dust.

**STORAGE:** Keep tightly closed in a cool, dry and well-ventilated environment. Keep away from heat, sparks, and flames. Keep away from incompatible materials. Store at temperatures not exceeding 50°C.

**SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION**

**EXPOSURE LIMITS**

Ingredient Name	CAS No.	%by Weight	ACGIH TLV (Mg/M <sup>3</sup> )	OSHA PEL (Mg/M <sup>3</sup> )
Zirconium Silicate	14940-68-2	60.0	5.0	5.0
Quartz	14808-60-7	1.0 - 2.0	0.05	10.0

COMPONENT	OSHA PEL	ACIGH TLV	NIOSH IDLH
2-Propenenitrile, polymer with 1,3-butadiene and ethenylbenzene 9003-56-9	-	-	-

**TLV:** Threshold Limit Value over 8 hours of work.

**PEL:** Permissible Exposure Limit

**ADDITIONAL PROTECTION:** Provide eyewash station and washing facilities accessible to areas of use and handling.

### ENGINEERING CONTROLS

**Engineering Measures:** Investigate engineering techniques to reduce exposures below airborne exposure limits. Provide ventilation if necessary to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

### EXPOSURE MONITORING

**Exposure Limits:** See table above.

**Hygiene Measures:** Avoid contact with eyes.

### PERSONAL PROTECTIVE EQUIPMENT

**Eye protection:** Avoid eye contact. To minimize the risk of injury to eyes, always wear appropriate protective safety glasses, side-shields, or chemical safety goggles.

**Skin protection:** Avoid skin contact with molten polymer. Wear appropriate protective clothing to minimize risk of injury to the skin from contact with dust or physical abrasion. Long sleeved/impervious clothing if contact is probable and skin is sensitive. Protect contact with skin when processing; while material is hot, wear insulated safety gloves; wash hands after handling. Coveralls should be made from fire resistive materials which tend to not accumulate static charges. They should be designed in such a way as to avoid accumulation of dust in cuffs, pockets, etc.

**Respiratory protection:** Respirator must be worn if exposed to dust. Wear respirator with dust filter. Recommended respiratory protection: N95. If irritation or other symptoms are experienced, follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard 149 approved respirator. Respiratory protection is needed if any dust accumulates. Consult an industrial hygiene professional prior to respirator selection and use. 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. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

**Hand protection:** While material is hot, wear insulated safety gloves; wash hands after handling.

**Hygiene measures:** Provide regular cleaning of equipment, work area and clothing. Handle in accordance with good industrial hygiene and safety practices. Do not eat, drink or smoke when using this product. Wash hands before breaks and immediately after handling product. Avoid contact with eyes. Do not breathe dust. Use personal protective equipment as required.

**Special hazard:** Workers should be protected from the possibility of contact with molten material during fabrication.

**Environmental Protection:** Do not allow to enter drains or watercourses.

**SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES**

<b>Physical State:</b>	Solid
<b>Appearance:</b>	Filament, Pellets
<b>Color:</b>	Grayish
<b>Odor:</b>	Slight
<b>Odor Threshold:</b>	No information available.
<b>Melting/Freezing Point:</b>	150-180°C (302- 356°F)
<b>Boiling Point:</b>	No information available.
<b>Flash Point:</b>	No information available.
<b>Evaporation Rate:</b>	No information available.
<b>Flammability:</b>	No information available.
<b>Flammability Limits:</b>	No information available.
<b>Vapor Pressure:</b>	Not applicable
<b>Vapor Density:</b>	Not applicable
<b>Specific gravity:</b>	2.0 - 3.95 (H2O=1)
<b>Relative Density:</b>	No information available.
<b>Water Solubility:</b>	Negligible (<0.1%), Insoluble in cold and hot water
<b>Percent Volatile (v/v):</b>	0%
<b>Chemical Stability:</b>	No information available.
<b>Conditions to avoid:</b>	No information available.
<b>Solubility in other solvents:</b>	Insoluble
<b>Partition Coefficient:</b>	No information available.
<b>Auto-Ignition Temperature:</b>	388°C
<b>Hazardous Decomposition Products:</b>	No information available.
<b>Possibility of Hazardous Reactions:</b>	No information available.
<b>Hazardous Polymerization:</b>	No information available.
<b>Decomposition Temperature:</b>	250°C

<b>Viscosity:</b>	No information available.
<b>Explosive Properties:</b>	No information available.
<b>Oxidizing Properties:</b>	No information available.
<b>Other Information:</b>	
Softening Point:	80-100°C
VOC Content (%)	negligible
Bulk Density:	0.8-1.3 g/cc (50-80 lb/ft <sup>3</sup> )
MEC:	45-120 (g/m <sup>3</sup> )
MIE:	4-13 (mJ)
KST:	90-300 (bar-m/sec)
MIT (layer):	650°C

## **SECTION 10 - STABILITY AND REACTIVITY**

**INCOMPATIBILITY:** Strong oxidizing agents. See NFPA "Fire Protection Guide for Hazardous Materials" for further information.

**CHEMICAL STABILITY:** Stable under recommended storage conditions.

**HAZARDOUS POLYMERIZATION:** Will not undergo hazardous polymerization.

**CONDITIONS & MATERIALS TO AVOID:** Avoid keeping resin molten for excessive periods of time at elevated temperatures. Prolonged exposure will cause polymer degradation. Dust formation. Oxidizing agents/materials, Strong bases. Incompatible with strong oxidizing agents and halogens.

**HAZARDOUS DECOMPOSITION PRODUCTS:** Burning produces noxious and toxic fumes, Carbon monoxide (CO), Carbon Dioxide (CO<sub>2</sub>). Exothermic reaction with water, acids, alkalis, to generate hydrogen and heat.

## **SECTION 11 - TOXICOLOGICAL INFORMATION**

**Principal routes of exposure:** Skin contact.

### **PRODUCT INFORMATION:**

**Zirconium Silicate:** Following single or repeated intraperitoneal doses, this material was considered to be physiologically inert. Following repeated inhalation exposure to dust of this material, radiographic lung shadows were reported in rats; however, histological examination of the lung tissues showed no changes. Following implantation of a disc of this material into the muscle tissue of rabbits, histological

examination of the surrounding tissues did not show any effects that were different from other materials used in medical implants. This material contains trace quantities of naturally occurring radioactive uranium, thorium and radium (106-120 Picocuries/gram). Overexposure to respirable dust containing radioactive uranium, thorium and radium may cause lung cancer. (Zircon is exempt from NRC regulations for source material per 10 CFR 40, since it falls under the definition of material containing less than 0.05% uranium or thorium. However, calculations show that observance of 2.2-2.8 mg/m<sup>3</sup> 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).

**Zirconium and Zirconium Compounds:** Single exposure (acute) studies indicate that zirconium and zirconium compounds are slightly toxic to mice, rats and guinea pigs if swallowed [LD<sub>50</sub> 990 to 2,290 mg/kg (insoluble zirconium salts)] and practically non-toxic to rats, guinea pigs, rabbits, cats and dogs if inhaled (LC<sub>50</sub> >6 mg/l).

**Aluminum Silicate:** Workers exposed to a hydrated clay of this material, have been reported to have experienced lung effects ranging from mild pneumoconiosis, a non-disabling lung change, to progressive pulmonary fibrosis and emphysema. Exposure to the anhydrous form of this material used for refractory and porcelain manufacture, has been reported to cause interstitial pulmonary fibrosis in workers and in experimental animals; these findings are complicated by the presence of cristobalite. Another report has indicated that occupational exposure to this material in kitty litter dust caused pulmonary fibrosis; however, further evaluation of these workers and lack of pulmonary toxicity in animals from instillation of this material in the lungs suggests that smoking behavior may have been the most significant causative factor. Oral administration of aluminum silicate to dogs and rats showed no evidence of toxicity to kidneys or other organs. In vitro studies and long-term inhalation studies with this material have shown aluminum silicate to be less cytotoxic and carcinogenic than other inorganic fiber dusts. Other studies have suggested an association between aluminum and neurological degenerative diseases, including Alzheimer's disease, dialysis dementia and reduced neural-motor functions. In aluminum sensitive animal species such as cats and rabbits, a pathological change noted in neurons is an accumulation of neurofibrillary tangles. Neurofibrillary tangles and increased brain levels of aluminum are also observed in patients with Alzheimer's disease and dialysis dementia; however, these tangles are associated with a variety of neurological disorders. Because there are scientific questions regarding these studies, the causative association between aluminum and these diseases has not been demonstrated. In a study of occupationally exposed workers to aluminum dusts, no increased mortality from Alzheimer's disease or other neurological diseases was noted.

**Quartz:** Chronic inhalation of crystalline silica may cause a progressive pneumoconiosis (silicosis), a form of disabling lung disease (pulmonary fibrosis). Data from animal studies on crystalline forms of silica confirm the capacity of free crystalline silica to induce a fibrogenic response in lungs. Studies on a variety of laboratory animals (rats, guinea pigs, rabbits, and monkeys) using inhalation as well as intratracheal routes of exposure indicate the ability of crystalline silica to produce silicosis similar to that seen in man. In addition, experiments in animals have confirmed human experience that the presence of crystalline silica in the lung increased susceptibility to tuberculosis and other lung infections. Crystalline silica inhaled in the form of quartz is classified as "carcinogenic to humans" by the International Agency for Research on Cancer (IARC), and respirable forms of crystalline silica are listed as substances that "may reasonably be anticipated to be carcinogens" by the National Toxicology Program. The IARC listing is based on the determination that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica in the form of quartz from occupational exposures. Epidemiology studies cited by IARC give indications of increased risk for lung cancer from inhaled crystalline silica (quartz) resulting from occupational exposure. Studies involving heavy industrial exposure to silica in granite and foundry workers, brick factories and sandblasting produced increased levels of protein and enzymes in urine, which is indicative of kidney damage.

**Acute toxicity:** None established.

**Chronic toxicity:** None established.

**Specific effects:** None established.

**Long term toxicity:** None established.

**Mutagenic effects:** None established.

**Reproductive toxicity:** None established.

**Carcinogenic effects:** This product contains one or more substances which are classified by IARC as carcinogenic to humans (Group I), probably carcinogenic to humans (Group 2A) or possibly carcinogenic to humans (Group 2B).

COMPONENT	ACGIH	IARC	NTP	OSHA
2-Propenenitrile, polymer with 1,3-butadiene and ethenylbenzene 9003-56-9	-	Group 3	-	--

**Target organ effects:** Eyes, Respiratory system.

**Ingestion:** May cause gastrointestinal discomfort if consumed in large amounts. Not an expected route of exposure.

**Inhalation:** Inhalation of dust in high concentration may cause irritation of the respiratory system.

**Eye Contact:** Dust contact with the eyes can lead to mechanical irritation.

**Symptoms related to the physical, chemical, and toxicological characteristics:** Redness. Coughing and/or wheezing.

**Delayed and immediate effects and also chronic effects from short and long term exposure:**

**Irritation:** Product dust may be irritating to eyes, skin, and respiratory system.

## SECTION 12 - ECOLOGICAL INFORMATION

**Ecotoxicity:** Pellets may be eaten by wildlife and should be swept up and placed in closed containers. EC50/72h/algae > 1100 mg/L

**Persistence and degradability:** Not readily biodegradable.

**Bioaccumulation:** Not expected to bioconcentrate or bioaccumulate.

**Mobility:** Is not likely mobile in the environment.

**Other adverse effects:** This substance is not considered to be persistent, bioaccumulating nor toxic (PBT).

**Ozone:** Not applicable.

**SECTION 13 - DISPOSAL CONSIDERATIONS**

**WASTE DISPOSAL METHODS:** Solid or chemical waste generators must determine whether a discarded waste is classified as a hazardous waste. U.S. EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local waste regulations to ensure complete and accurate classification. Should not be released into the environment. Do not contaminate ponds, waterways or ditches with chemical or used container.

**CONTAMINATED PACKAGING:** Empty remaining contents. Do not re-use empty containers. Empty containers should be transported/delivered using a registered waste carrier to local recyclers for disposal.

**SECTION 14 - TRANSPORT INFORMATION**

**DOT:** Not regulated.  
**MEX:** Not regulated.  
**ICAO:** Not regulated.  
**IATA:** Not regulated.  
**IMDG:** Not regulated.  
**UN NUMBER:** N/A.

**SECTION 15 - REGULATORY INFORMATION**

**DOT:** This product is not regulated by USDOT as a Hazardous Material (49 CFR 172.101). No UN code assigned. No placard required for transportation.  
**SARA (TITLE III):** Under applicable definitions, this material may meet the criteria for a delayed (chronic) health hazard.  
**SARA (SECTION 313):** Not Listed.  
**CALIFORNIA PROP. 65:** Not Listed.  
**TSCA:** Not Listed.  
**DSCL (EEC):** Listed on the DSCL inventory.  
**RCRA HAZARDOUS WASTE NUMBER:** Not Listed.

COMPONENT	SARA 313 – Threshold Values %
1,3-butadiene 106-99-0	0.1

Electrical equipment must be suitable for use in hazardous atmospheres involving Group E combustible dusts in accordance with 29CFR1910.307. Refer to the National Electrical Code (NFPA 70) for guidance in determining the type and design of equipment and installation which meets this requirement.

**CLEAN AIR ACT, TITLE VI (1990):** This product does not contain, nor was it manufactured using

ozone depleting chemicals.

**CALIFORNIA PROPOSITION 65:** This product contains the following Proposition 65 chemicals:

COMPONENT	CALIFORNIA Prop. 65
1,3-butadiene	Carcinogen Developmental Female Reproductive
Quartz	Carcinogen

Inventory Status:

TSCA (USA): Listed\*

DSL (Canada): Listed\*

NDSL (Canada): Not Listed

EINECS (Europe): Listed\*

AICS (Australia): Listed\*

ENCS (Japan): Not Identified\*\*

IECSC (People's Republic of China): Listed\*

PICCS (Philippines): Listed\*

ECL (Korea): Listed\*

ECN (Taiwan): Listed\*

\*\*Listed" indicates that all components of this product comply with the inventory requirements administered by the governing country(s).

\*\* Pure metals are not specifically identified by CAS or ENCS number.

**SECTION 16 - OTHER INFORMATION, INCLUDING THE DATE OF PREPARATION OF THE LAST REVISION**

**LABEL REQUIREMENTS:** Not expected to produce significant adverse health effects when the recommended instructions for use are followed.

NFPA HAZARD RATINGS	HEALTH	0
	FLAMMABILITY	1
	PHYSICAL HAZARD	0
	INSTABILITY	-
	4=Severe 3=Serious 2=Moderate 1=Slight 0=Minimal	

HMIS HAZARD RATINGS	HEALTH	0
	FLAMMABILITY	1

	PHYSICAL HAZARD	0
	PERSONAL PROTECTION	X
4=Severe   3=Serious   2=Moderate   1=Slight   0=Minimal		

**DISCLAIMER:** The information provided in this SDS is based on available data from reliable sources and is correct to the best of The Virtual Foundry, Inc's knowledge. The Virtual Foundry, Inc makes no warranty, express or implied, regarding the accuracy of the data or the results obtained from the use of this product. Nothing herein may be construed as recommending any practice or any product in violation of any law or regulations. The user is solely responsible for determining the suitability of any material or product for a specific purpose and for adopting any appropriate safety precautions. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

**REVISED DATE:** December 2019