TEGO™ Polymers

Material Safety Data Sheet

Section I - CHEMICAL PRODUCT & COMPANY IDENTIFICATION

Manufacturer's Name: Entegris, Inc.	**Emergency Telephone Number:** CHEMTREC USA: 800-424-9300 International: 703-527-3887 (Collect)
Address: 101 Peavey Road Chaska, Minnesota 55318 **Telephone Number** **For Information:** 952-556-3131	**MSDS Issue Date:** 7/27/2010 **MSDS Revision:** NA **MSDS Revision Date:** NA **MSDS Number:** NA
Product: TEGO™ Polymers	**Product Number(s):** DAI-N79XXXX-XX-67.5
Substance Identification: A static dissipative carbon nanotube filled ethylenetetrafluoroethylene (ETFE) fluoropolymer composite.	

Section II – COMPOSITION AND INFORMATION ON INGREDIENTS

Components	CAS NO.	Percent
Ethylenetetrafluoroethylene (ETFE) copolymers	Trade Secret	85-100
Carbon Nanotube	Not Established	1-15
Cobalt and Cobalt Compounds	7440-48-4; 1308-06-1	≤0.15

Section III – HAZARD IDENTIFICATION AND EMERGENCY OVERVIEW

Emergency Overview: Heated above 350°C can evolve hydrogen fluoride (CAS No. 7664-39-3) and carbonyl fluoride (CAS no. 353-50-4) as degradation products. Before using, read the Fluropolymers Safe Handling Guide published by the Society of the Plastics Industry.
Processing at elevated temperatures may liberate fumes that can cause Polymer Fume Fever. Extended processing at temperatures above 400°C or 752°F could result in autocatalytic degradation with "blow backs" through extruder, feed hopper or barrel front.
Pellets may give off an odor. Pellet material can burn in a fire creating dense smoke. Fumes generated during melt processing may cause eye, skin and respiratory tract irritation. May cause mechanical irritation (abrasion). Spilled materials may present a slip hazard. Molten materials can cause severe burns.
Target organs: Respiratory tract, eyes and skin.

Route(s) of Entry:

Inhalation: Pellets are not expected to cause adverse respiratory effects in supplied form. Mechanical or thermal processing and/or decomposition of material may create particles or fumes that may irritate the respiratory tract.

Skin absorption: Not likely to occur in the pellitized or processing form, however it is recommended to cleanse skin after contact occurs.

Ingestion: Not acutely toxic.

Section III (Cont.)

Health Hazards (Acute and Chronic): Inhalation of fumes from overheated ETFE may cause polymer fume fever, a flu-like illness with fever, chills and cough of approximately 24-hour duration. There are some reports in the literature of persistent pulmonary effects in individuals, especially smokers, who have repeated episodes of polymer fume fever. Because of complicating factors, such as mixed exposures and smoking history, these findings are uncertain. Protections against acute exposure should also provide protection against any potential health effects. Smokers should avoid contamination of tobacco products, and should wash their hands before smoking. Eye contact with ETFE may cause mechanical eye irritation with discomfort or tearing. Processing material above 270^{o}F can liberate hydrogen fluoride, which may irritation to the eyes, skin and respiratory tract. Molten materials can cause severe burns. Once impregnated, carbon nanotubes are not likely to be separated from the polymer matrix. The toxicity of carbon nanotubes has not been fully investigated, therefore due care must be taken in handling and use.
The cobalt component is classified by the IARC as a 2B Possible carcinogen.

Signs and Symptoms of Exposure: In the supplied form, the ingredients are encapsulated in plastic pellets, and therefore the likelihood of exposure is low unless the product form is modified. If the pellets or molded products undergo additional mechanical processing (i.e., grinding, sanding, milling, etc.), compound particulates may cause mechanical irritation to the eyes and temporary discomfort to the respiratory tract at concentrations above the occupational exposure limit. Keep particulate levels below occupational exposure limits.
The cobalt component is classified by the IARC as a 2B Possible carcinogen. Acute skin exposure to cobalt may cause allergic skin reactions, while chronic skin exposures may cause dermatitis with symptoms of red, itchy, dry skin.
Gases and fumes evolved during thermal processing or decomposition may irritate the eyes, skin or respiratory tract. Molten materials can cause severe burns.

Medical Conditions Generally Aggravated by Exposure:
Individuals with preexisting diseases of the lungs may have increased susceptibility to the toxicity of excessive exposures from the thermal decomposition products.
There are no known health effects aggravated by exposure to this product, however certain sensitive individuals and individuals with respiratory impairments may be affected by exposure to components in the processing vapors/particulates if not properly ventilated. Cobalt and cobalt compounds are bound with the polymer; therefore they are not expected to be a health hazard unless the resin is mechanically processed (i.e., ground, sanded, cut, etc.) where particulate may be released. Exposures to cobalt and cobalt compounds may cause occupational asthma.

Section IV – FIRST AID

In Raw Material Form:

Eyes: Wash eyes immediately with large amounts of water for a minimum of 15 minutes, occasionally lifting the upper and lower lids until no evidence of chemical remains. Immediately consult a physician for medical treatment.

Skin: Wash material off skin with soap or mild detergent and water. If redness, itching or burning sensation develops consult a physician for medical treatment.

Ingestion: Not probable due to nature of the material. If large amounts of the material are swallowed, consult a physician for medical treatment.

Inhalation: Not probable due to physical form of the material.

Section IV (Cont)
In Melt Processing Form:
Eyes: For eye contact with molten material, immediately flush with large amounts of water for a minimum of 15 minutes, occasionally lifting the upper and lower lids until no evidence of chemical remains. Immediately consult a physician for medical treatment.
Skin: For skin contact with molten material, cool rapidly with water or ice and consult a physician for medical treatment. For skin contact with fume condensate, wash thoroughly with soap and water. If irritation develops, consult a physician for medical treatment.
Ingestion: Not probable due to nature of the material. If large amounts of the material are swallowed, immediately consult a physician for medical treatment.
Inhalation: For processing fume inhalation or irritation, immediately remove person to fresh air. If coughing, difficulty breathing or other respiratory symptoms develop, immediately consult a physician for medial treatment. If exposed to fumes from overheating or combustion, move to fresh air and consult a physician if symptoms persist.

Section V – FIRE FIGHTING MEASURES

Flash Ignition Temperature: 470^{o}C (878^{o}F) via method ASTM D1929	**Self Ignition Temperature:** 510-515^{o}C via Method ASTM D1929
Extinguishing Media: Water, foam, dry chemical, carbon dioxide (CO_2)	
Fire and Explosion: Combustible material. During a fire, intense heat, irritating smoke and toxic gases (hydrofluoric acid and carbonyl fluoride) may be generated by thermal decomposition and combustion. Additional mechanical processing may create particulates that may form explosive mixtures with air. Users should investigate best management practices and engineering controls to keep particulates from creating dangerous conditions. To reduce the risk for dust explosion, do not allow particulates to accumulate.	
Fire Fighting Instructions: Wear self-contained breathing apparatus. Wear full protective equipment. Hydrogen fluoride fumes emitted during a fire can react with water to form hydrofluoric acid. Wear neoprene gloves when handling refuse from fire.	

Section VI – ACCIDENTAL RELEASE MEASURES

Steps to Be Taken in Case Material is Released or Spilled: If molten, allow material to cool and place into an appropriate container for disposal. Loose pellets may present a slipping hazard. Avoid particulate formation. Vacuum particulates using a HEPA equipped vacuum or sweep pellets up immediately and place in proper container for disposal or recovery.

Section VII – HANDLING AND STORAGE

Handling: Open containers in a well ventilated area. Wear protective gloves and safety glasses. Avoid grinding or sanding material into particulate or dust without proper ventilation or respiratory protection. Avoid contamination of tobacco/tobacco products with dust from this material.
Storage: Store in a cool dry place. Keep containers closed to prevent contamination.

Section VIII – PERSONAL PROTECTIVE EQUIPMENT AND EXPOSURE CONTROL

Ingredient:	**OSHA - PEL**	**ACGIH - TLV**
Particulates	15 mg/m^3 (Total Dust) 5 mg/m^3 (Respirable)	10 mg/m^3 (Inhalable Fraction) 3 mg/m^3 (Respirable)
Cobalt and cobalt compounds	0.1 mg/m^3 as Co (dust and fume)	0.02 mg/m^3 as Co
Hydrogen fluoride	3 ppm (8 hr TWA)	0.5 ppm as F (8 hr TWA) 2 ppm as F (Ceiling)
Carbonyl fluoride	None established	2 ppm, 5.4 mg/m^3 (8 hr TWA) 5 ppm, 13 mg/m^3 (STEL)

Ventilation: Provide local exhaust ventilation at processing equipment to keep fumes and potential particulates below applicable regulatory limits.

Respiratory Protection: With properly designed ventilation, use of respiratory protection should not be necessary. When processing fumes are not adequately controlled, use NIOSH approved respirators for the hazard present.

Personal Protection:

Hand: Wear heat resistant gloves when handling molten materials.
Eyes: Wear safety glasses with side shields when handling.
Skin and body: Protect skin and body when handling molten materials.
Additional Protective Measures: After handling materials, employees should wash their hands and face before eating, drinking, or using tobacco products.

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Section IX – PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point	Not Available	**Specific Gravity (H20 = 1)**	1.68
Vapor Pressure (mm Hg.)	No available	**Melting Temperature (^{0}C)**	255-280^{o}C
Vapor Density (AIR = 1)	Not available	**Evaporation Rate (Butyl Acetate = 1)**	Not available
Solubility in Water: Insoluble			
Appearance and Odor: Black with minimal to no odor.			

Section X – STABILITY AND REACTIVTIY

Stability: Stable under normal storage, handling and processing conditions

Incompatibility (Materials to Avoid): Incompatible or can react with finely divided metal powders (e.g., aluminum and manganese) and potent oxidizers such as fluorine and related compounds. Contact with incompatibles can cause fire and/or explosion.

Hazardous Decomposition or Byproducts: Small amounts of hydrogen fluoride may be evolved at about 350^{o}C (662^{o}F), with larger amounts at higher temperatures.

Hazardous Polymerization: None known.

Conditions to Avoid: Do not exceed melt temperature recommended in product literature. Do not allow product to remain in barrel at elevated temperatures for extended periods. Avoid particulate formation and ignition sources. Avoid thermal decomposition temperature of 350^{o}C (662^{o}F) where small amounts of hydrofluoric acid may be evolved, with larger amounts at higher temperatures.
Processing at elevated temperatures may liberate fumes that can cause Polymer Fume Fever. Extended processing at temperatures above 400^{o}C or 752^{o}F could result in autocatalytic degradation with "blow backs" through extruder, feed hopper or barrel front.

Section XI – TOXICOLOGICAL INFORMATION

Toxicological data:
Ethylenetetrafluoroethylene (ETFE): Inhalation 4 hour LC_{50}: 7300 mg/m^3 (rats).
Carbon Nanotubes (Results based on similar product):
Acute Oral Toxicity: LD_{50}: >5000 mg/kg (rat)
Acute Dermal Toxicity: LD_{50}: >2000 mg/kg (rat)
A few carbon nanotube studies have reported inflammation and fibrotic reactions in rodent lungs following intratracheal installation, an application method that is not directly relevant to humans, and which may produce artificial results. The materials tested are not known to be identical to the carbon nanotubes contained in this polymer matrix, which may differ significantly in a number of parameters including composition, all of which can influence a toxicological profile.

Carcinogenicity: Cobalt and cobalt compounds are listed by the IARC as a 2B Possible Carcinogen.

Section XII – ECOLOGICAL INFORMATION

Do not allow material to be released to the environment without proper governmental permits. Plastic pellets are inert and benign in terms of their physical impact on the environment. Material must not be released to the environment since they can be consumed by animal and aquatic species.

Section XIII – DISPOSAL INFORMATION

Discarded product is not a Hazardous Waste under RCRA (40 CFR 261). Recycling or reuse of this product is encouraged. The user is responsible for proper classification and management if additives are introduced. Dispose of this material in accordance with country, regional and local environmental regulations. This material should not be incinerated unless scrubbing of hydrogen fluoride and other acidic combustion products is available.

Section XIV – TRANSPORTATION INFORMATION

Transportation and Hazardous Materials Description: This material is not a hazardous material for shipment in accordance with the US Department of Transportation or IATA regulations.

Section XV – REGULATORY INFORMATION

OSHA Status: This product is not regulated by 29 CFR 1910.1000 Subpart Z.

CERCLA Reportable Quantities:

SARA Title III:

Section 302 Extremely Hazardous Substances: Not listed

Section 311/312: Threshold reporting quantity based on maximum amount of molten state material on site at one time

Section 313: Not listed

TSCA: The ETFE polymer meets the Polymer Exemption in TSCA. Carbon nanotubes are manufactured under a Research and Development exemption. For use within the United States, handle in accordance with TSCA R&D requirements.

US EPA RCRA (40 CFR 261): If discarded in its purchased form, this product would not be a hazardous waste either by listing or characteristic. However, under RCRA, it is the responsibility of the user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified and managed as a hazardous waste.

California Proposition 65: This product contains chemicals regulated by California Proposition 65.

Section XVI – ADDITIONAL INFORMATION

The chemical, physical and toxicological properties of this material have not been thoroughly investigated. Exercise due care.

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