

The Best Use of Chemical Stability of Polyethylene

Characteristics

Outstanding Physical Properties

To meet your requirements, FLO-THERE is available in many grades. Some grades retain all the excellent physical and chemical properties of raw material polyethylene resins, and others are modified for individual customers. Made by powdering colored pellets manufactured by our unique coloring process, FLO-THERE provides a uniform surface finish with fine color and gloss. Optional colors are available in addition to the various standard colors. A dry blend is also available to simplify coloring.

Stable Quality

Because of our unique pulverizer and stringent quality control, FLO-THERE contains no moisture, solvent or other foreign matter and there is almost no variation of particle size distribution or other physical properties between the production lots.

Notes for Application

The main grades of FLO-THERE have passed the tests conducted in conformity with the standards (Notification No.20.....) of the Food Sanitation Act for plastics devices, containers and packages. We endeavor to maintain excellent sanitation by using resins, pigments, and additives strictly limited by the self-imposed controls of The Safety Conference of Polyolefin and Other Materials.



Safe and Easy to Use Application Methods

Properties

Chemical Properties

FLO-THERE is very stable and has excellent resistance to water and chemicals in comparison with any other materials. It particularly has extremely high resistance to water with water absorption rate of 0.01% or less (per day at 25°C). It also has high resistance to chemicals such as alkalis, inorganic salt solutions and all acids except some chlorine containing chemicals. If there is a possibility that FLO-THERE is affected by some sorts of surface active agents, alcohol, aldehyde, ketone, acid, ester and other chemicals, use our special stress crack resistant grades.

Chemical Resistance of FLO-THERE

(Table 1)

Chemicals	Concentration (%)	20°C	60°C
Sulfuric acid	10-60	○	○
	98	△	×
Nitric acid	5-25	○	○
	50	△	×
Hydrochloric acid	Any concentration	△	×
Phosphoric acid	<90	○	○
Chromic acid	Electrolytic solution	○	○
Sodium hypochlorite	15	○	○
Sodium hydroxide	Concentrated	○	○
Sodium carbonate	Concentrated	○	○
Aqueous solution of ammonia	Solution of specific gravity of 0.99	○	○
Ammonia gas	Dry gas	○	○
Chlorine water	?	○	○
	Saturated	○	△
Chlorine gas	Dry gas	△	×
Sulfurous acid gas	Dry gas	○	○
Acetic acid	10-60	○	△
	60 g/ccal	△	×
Formic acid	3-80	○	○
	100	△	△
Oxalic acid	Saturated	○	○
Methyl alcohol	<50	○	○
	100	△	△
Ethyl alcohol	<90	○	○
	100	△	△
Formaldehyde	40	○	○
Carbon tetrachloride	100	×	×
Trichloroethylene	100	×	×
Benzene	100	×	×
Petroleum		×	×
Gasoline		×	×
Mineral, animal and vegetable oil		△	×

Note 1:
 ○ ... Usable
 △ ... Usable under limited conditions
 × ... Not usable

Note 2:
 These figures and explanations above are shown only for reference purposes, and may not be applicable in different conditions. Users are asked to confirm by testing before use.

Electrical Properties of FLO-THERE

Made from polyethylene of good electrical properties, FLO-THERE is suitable for electrical material.

Electrical Properties of FLO-THERE (Table 2)

Volume resistivity	Ω·cm	>10 ¹⁴
Dielectric breakdown strength	kV/mm	40 (Short time method)
Dielectric constant	(10MHz)	2.3-2.4
Dielectric loss tangent	(10MHz)	<0.0005

Thermal Properties of FLO-THERE

FLO-THERE has the following thermal properties:

Thermal Properties of FLO-THERE (Table 3)

Heat conductivity at 20°C	0.290 kcal/mh°C
Specific heat (solid) at 20°C	0.55 cal/g°C
Specific heat (liquid) at 120-140°C	0.70 cal/g°C
Coefficient of linear expansion	2.2 × 10 ⁻⁴ /m/°C
Decomposition point (in a vacuum)	280-300°C
Ignition point	340°C





Safe and Stable Available for A Wide Range of Applications

Use Application Methods

Coating

Coating FLO-THENE to materials such as metals gives no risk of fire, poisoning or air pollution because, unlike liquid paints, no solvent is used to produce FLO-THENE. In addition, because it is relatively easy to control film thickness, a protective film with few pinholes can be obtained.

Fluidized Bed Coating

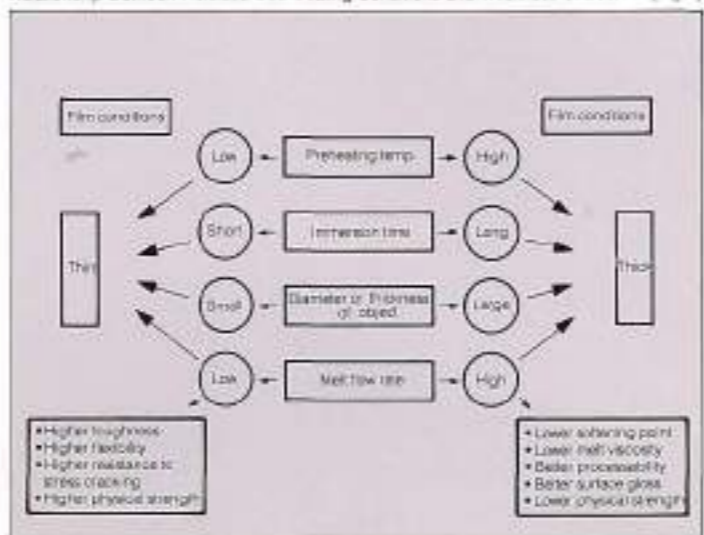
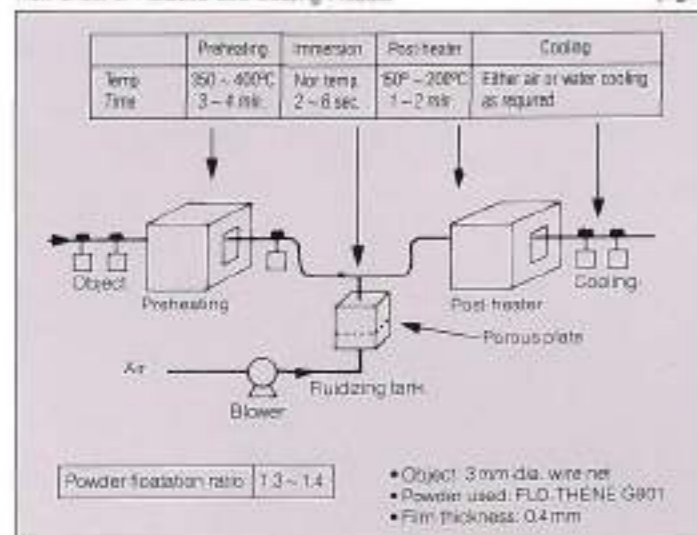
The fluidized bed coating method has been widely adopted to coat objects such as metals and glass.

First put FLO-THENE into a fluidizing tank with a porous base plate at the bottom, and fluidize it with air blown from below. Then put a preheated object into the tank and FLO-THENE will cling to the object throughly. After

several seconds of immersion in FLO-THENE, remove the object and post-heat it to obtain a more beautiful finish.

Flow Sheet of Fluidized Bed Coating Process

(Fig.1) Relationship Between Fluidized Bed Coating Conditions and Thickness of Coat (Fig.2)



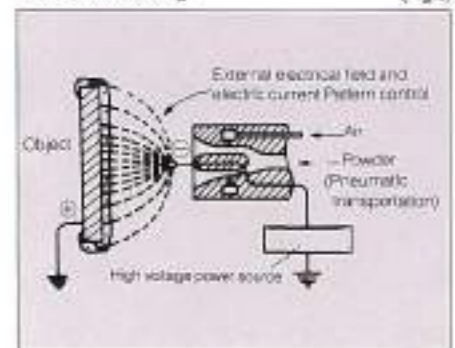
Electrostatic Coating

Electrostatically charge the resin powder with a high voltage (60-90KV), and spray it on the object, so that it adheres by Coulomb interaction. The object is then heated to form a more uniform film. Thick film, if needed, is obtained by adopting both preheating and post-heat.

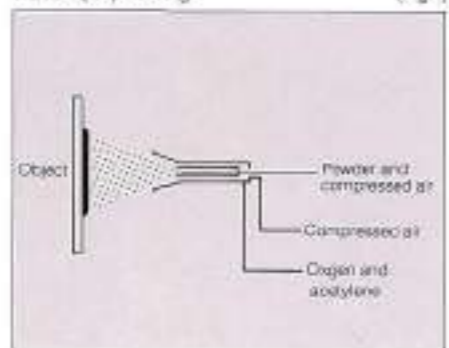
Flame Spray Coating

Feed a resin powder under compression into the flame of a powder coating gun and spray the momentarily melted resin on the coating surface. This method uses simple facilities and is suitable for on-site application. The film made by this method is easily degraded by heat. Use our heat resistant grades with this method.

Electrostatic Coating (Fig.3)



Flame Spray Coating (Fig.4)



Application Examples

Photo 1: An Application of FLO-THENE F



Examples of Coating with FLO-THENE and Applicable Grades

(Table 4)

Application	Grade	General	Weather resistant	Antistatic	ESC resistant	Adhesion	Surface gloss	Heat resistant
Pipe			○		○	○		○
Fabric			○			○		○
Refrigerator parts		○		○	○		○	
Basinet		○	○	○			○	
Automobile component		○			○	○		○
Electrical part		○	○	○	○			
Kitchen utensil		○		○	○		○	
Drum car interior lining						○		○
Tank					○			○

(○: Usable)

Powder Molding

The rotational powder molding method is more suitable as a method to mold powder polyethylene than other methods, such as injection molding and blow molding, because it requires lower costs for facilities and molds. This method is suitable not only to manufacture various products in small quantities, but also to manufacture economically large containers free of residual stress, which are difficult to manufacture by other methods.

The powder molding grade of FLO-THENE has excellent mechanical properties such as rigidity and impact strength and good stress-cracking resistance. These properties are effectively utilized in combination with the characteristics of the rotation molding method. In addition, the molding grade of FLO-THENE is suitable for the molding of sandwich structures having a foamed middle layer, because of both its excellent foaming ability and processability. The sandwich structure makes the moldings tougher and more heat retentive for the same quantity of resin used.





For your Intended Application select from Various Grades of FLO-THENE

Grades

General grade

The general grade of FLO-THENE, manufactured to retain the excellent characteristics of polyethylene, has powder characteristics suitable for fluidized bed coating due to the coloring with our unique compounding technique and our pulverizing technique. Products available in this grade are suitable for various application conditions.

Characteristics

1. This grade produces highly pure and stable products
2. This grade can be freely colored and produces a film of vivid color.
3. A variety of standard colors are available.
4. This grade has a high safety standard, meeting the standard specified by Notification No. 20 of the Ministry of Health and Welfare.

Properties of General Grade Products

MFR20: Physical properties suitable for a wide range of application conditions with appropriate processability.
MFR25: Processability improved as a wide-use grade.
MFR30: Good processability at low temperatures because of high melt flowability.
MFR50: Suitable for processing objects of low heat capacity because of higher melt flowability than MFR30.

Gloss Treatment

The film gloss of the general grade is generally about 50% at a 60° reflection angle (as measured with a glossmeter) our gloss treatment increases the gloss up to about 80%. This treatment is ideal for applications requiring a beautiful finish.

Weather Resistant Grade

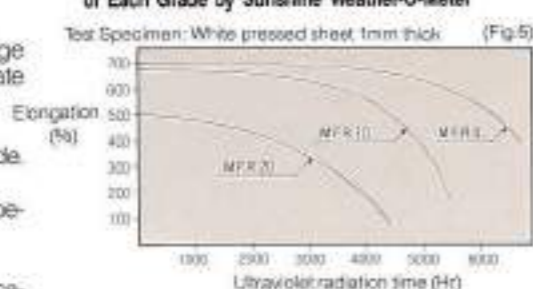
Under exposure to outdoor conditions such as light, rain and wind, polyethylene film may change in color, crack, and finally peel off, causing problems of appearance and function.

The tough film of the improved weather resistance grade of FLO-THENE can withstand severe outdoor conditions without cracking or peeling, so that it keeps its vivid color and usability for a long time.

Characteristics

1. This grade has excellent physical properties such as weather resistance.
2. This grade produces a coating film of vivid color and excellent gloss.
3. This grade is usable in combination with other grades such as the adhesive grade and the E.S.C. resistance grade.

Weather Resistance Data (Evaluation by Elongation) of Each Grade by Sunshine Weather-O-Meter



Radiation conditions:
 Temperature: 63°C on a black panel
 Humidity: 65%RH
 Spray: 18min/120min.

Adhesive Grade with Improved Processability High MFR Type

The FLO-THENE adhesive grade with improved processability exhibits excellent processability and adhesion properties in coating wire-made products such as baskets and racks which cannot be obtained with general polyethylene.

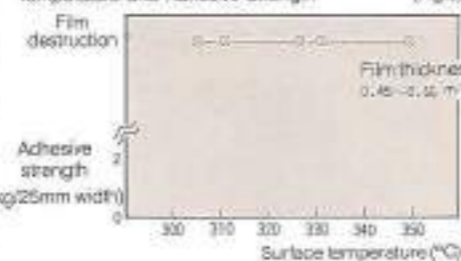
Characteristics

1. This grade produces a coating film of good processability and strong adhesive strength.
2. This grade comes in various colors and produces a coating film of vivid color and excellent gloss.
3. This grade has a higher surface hardness than general grades.

Adhesive Property

Object: Mild steel plate (70mm wide, 150mm long and 2mm thick) Degreased with trichlene
 Substrate surface temperature: 200-290°C
 Film thickness: 0.45-0.55mm
 Adhesive strength: Film destruction (25 mm width, 18C° peel)

Relationship Between Processing Temperature and Adhesive Strength (Fig.6)



Automobile Component Coating Grade

The FLO-THENE grade for coating automobile components is a special polyethylene powder with modified flowability and processability producing a coating film of uniform thickness.

Characteristics

1. This grade satisfies the demand for reducing the weight of automobile components
2. This grade provides a film of excellent physical properties.
3. This grade has an excellent edge covering property.
4. With this grade, film thickness can be freely controlled.
5. This grade has excellent resistance to heat, weather, adhesion and impact shock, moreover it prevents hanging of coated layer.

Heat Resistance

For the heat resistance level of each grade, the coat conditions after specified heat history was examined for clips coated by 0.8 to 1.0mm thick to find the following results.

Coat Conditions of Each Grade After Heat history (Table 5)

Grade	Condition	Results		
		Crack	Swell	Hang
Gen. purpose grade	120°C x 30min. Cooled in air 5 cycles	No crack	No swell	No hang
Processability improved grade	180°C x 30min. Cooled in air 5 cycles	No crack	No swell	Hang
Semi-heat resistant grade	200°C x 30min. Cooled in air 5 cycles	No crack	No swell	Hang
Heat resistant grade	200°C x 30min. Cooled in air 5 cycles	No crack	No swell	No hang

Grade of Strong Adhesive Strength and Improved Mechanical Strength

This grade of FLO-THENE combining strong adhesion to metals and a tough film is ideal for the corrosion resistance coating of facilities buried in severe conditions such as facilities buried in the ground, outdoor piping, chemicals equipment and construction materials.

Characteristics

1. This grade provides long lasting adhesive strength.
2. This grade produces a tough film with good bending resistance.
3. This grade shows resistance to heat applied during processing, and durability to heating and cooling cycles.
4. This grade has good chemical resistance. The four base products of this grade have especially high resistance to environmental stress cracking.

Adhesive Properties

Adhesion Properties of Each Grade
 Test specimen making conditions: Heating at 360-400°C x 4-8 min.

Property	Base material	Method and conditions of measurement	Results	
			MFR	MPR
Adhesive strength (Initial)	Steel plate (2mm thick)	25mm width 180° peel	> 10kg	> 10kg
			> 10kg	> 10kg
Adhesive strength (Final)	Steel plate (2mm thick)	Exposed to outside conditions for 3 years 25mm width 180° peel	> 10kg	> 10kg
			> 10kg	> 10kg

Special Polyolefin Adhesion Grade

The FLO-THENE special polyolefin adhesion grade has both the properties of polyethylene and the glossy appearance of vinyl chloride resins, exhibiting many excellent mechanical and chemical properties.

Characteristics

1. A film of this grade has a gloss equivalent to that of vinyl chloride resins.
2. A film of this grade, which has a high tensile strength and surface hardness, is superior to a film of low-density polyethylene resins in terms of resistance to cold, weather, stress cracking and other properties.

Adhesion Properties

Adhesion Strength to Metals (kg/25mm wide, 180 deg. peeling) (Table 7)
 Test specimen making conditions: Heating at 340°C x 4min, after clipping for 8 sec., heated at 200°C x 2min.

Metals	Adhesive strength
Steel	4
Black skin (Blasting finish)	5
Cull finish (Blasting finish)	5
Aluminum	10
Plated metal: Chrome plating	5
Tin plated	Feeling is impossible
Perforated	Feeling is impossible
Non-ferrous metal: Aluminum	45
Stainless steel	6
Brass	Feeling is impossible

Note:
 Data in Fig.5-6 and Table 5-7 are examples of measured values not specification values. See our leaflets on each physical property for details.