

HOT MELT PLASTISOLS

When properly compounded, hot melt vinyl plastisols have sufficient heat stability and flow characteristics to enable the processor to pour or inject the molten plastisol into a cold or room temperature mold. At the typical processing temperatures of 330°F (166°C) to 360°F (182°C), these plastisols exhibit low enough viscosity to allow the plastisol to flow (or pour) at those elevated temperatures. When cool, the hot melt plastisol is transformed into a soft rubbery substance, at which time the finished part can be removed from the mold.

Processing Equipment

Initial heating and melting as well as subsequent remelting of hot melt plastisols is done most efficiently in a container having excellent heat transfer and as much surface area as practical in contact with the heat source. Preferred materials for the heating vessel are aluminum, nickel, stainless steel, porcelain or Pyrex type glass. Ordinary steel might suffice, but hydrogen chloride will cause corrosion. Copper is also corroded by HCl and should not be used.

Vinyl is an excellent thermal insulator. Therefore, it is necessary to continually agitate the plastisol in the heated vessel. Slow positive agitation, which scrapes the surface vessel, will help prevent localized degradation.

It is necessary to use a heat source with temperature control (e.g., a jacketed tank with heated, circulating oil). A thermostatically controlled hot oil bath would be an ideal heat source, but satisfactory results have also been obtained by using electric hot plates, provided care is taken to keep heat distribution even and at all times below 400°F (204°C). Because degradation will occur rapidly at extremely high temperature, use of an open flame or electric element is generally unsatisfactory.

Vessel temperatures should be set to at least 400°F (204°C). Some customers may use temperature settings as high as 450°F (232°C), but care must be exercised as temperatures are increased above 400°F (204°C).

An air convection oven with uniform heating and reasonably accurate heat controls is also an excellent source for processing hot melt plastisols. Use an oven setting of 400°F (204°C) to bring the hot melt to 360°F (182°C) before pouring.

If an open container is used for heating on a hot plate a second heat source above the material will speed the melting process. This second heat source could be infrared heaters or a heating coil. If this is not particularly applicable to certain applications, a simple lid over the container being heated will prevent the molten surface from cooling.

Master Mold Preparation

Molds can be made of any material that is not attacked by the plasticizers in the vinyl. Styrene, ABS, nitrocellulose, and many acrylics are attacked rapidly. A good test for a mold making material is to immerse the mold material in the liquid, unfused plastisol for 24 hours to check for softening or distortion of the potential mold material. Mold materials containing moisture (i.e. wood and paper) may cause surface blistering and should generally be used very cautiously. A mold material that has been used satisfactorily is RTV Silicone.

Preparation of the master for accepting the molten mold material varies with the type master. A smooth metal master need only be preheated from 200°F (93°C) to 250°F (121°C) before pouring of the hot melt. A wooden master should be coated thoroughly with shellac. A porous plaster master should be coated with a soap, wax or silicone release agent to inhibit mechanical adhesion of the mold material to the master. To protect the master from possible thermal shock damage when pouring the hot melt, preheat the master to 250°F (121°C).

Plastisol Processing

The plastisol, as supplied, is a low viscosity liquid. Conversion is accomplished by heating the plastisol until the polyvinyl chloride resin in the plastisol is solvated by the liquid plasticizers in the plastisol, and further heated to a high enough temperature for proper flow and fusion. Minimum temperature for fusion is about 330°F (166°C). Minimum temperatures for molten flow depend upon the compound, its hardness, and the process technique, but could vary from 330°F (166°C) upward.

As the hot melt warms in the vessel, it will begin to phase from a liquid to a solid at around 250°F. At this point, it can be visually described as a lump surrounded by liquid. It will remain solid until the temperature reaches approximately 330°F (166°C) (many customers are worried about the presence of this solid phase, but should rest assured that it is a normal phenomenon). After the plastisol reaches the approximate 330°F (166°C) temperature, the solid material will begin to phase back into a liquid state.

It is important to understand that the hot melt be stirred during the heating process to assure more uniform heating of the mass. Additionally, the stirring of the mass will help break up the solid phase quicker.

If a cup or dipper is used to pour the hot melt it should be paced in the molten material at least 15 minutes before pouring so that it will reach an equilibrium temperature.

When additional material is required add fresh material from the shipping container direct to the heat exchanger and stir. If solid (previously processed) hot melt is to be reused for molds, cut it into thin sections and melt it in a batch of already molten material. The greater the surface area of the solid, the faster it will melt.

Excessive heat will cause degradation. Initially degradation is evidenced by discoloration. Eventually, hydrogen chloride, a corrosive, somewhat toxic, noxious gas, is liberated.

Pouring (Molten Material)

Pouring the hot melt plastisol over the preheated, non-porous master should be done in a uniform, continuous manner. Take care not to pour too rapidly so as to trap air bubbles. A smooth even coating over the surface of the master should be poured first while the viscosity is low, then completely fill the cavity in which the master is mounted.

Properties

Compounds of any color, including clear, can be utilized. Hardnesses ranging from 8 Shore A (fish lures) to 30 Shore A (casting molds) can be utilized.

The plasticizers in vinyl are also plasticizers for other plastics and many materials used in paints and lacquers. Prolonged contact, with the vinyl part, can result in plasticizer migration with resultant marring or degradation. Often, proper compounding of the vinyl plastisol can prevent or reduce plasticizer migration. Surface feel (slimy to dry), chemical resistance, and other characteristics vary, and desired properties can often be supplied by advising us of your requirements.

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