

## HOT MELT VINYL PLASTISOLS

Hot melt vinyl plastisols are liquid dispersions of polyvinyl chloride (PVC) resins, plasticizers, and miscellaneous additives. When properly compounded, these 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 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). When cool, the hot melt vinyl 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 re-melting of hot melt vinyl 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 (i.e. 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). Due to the fact that 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 manufacturers 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).

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An air convection oven with uniform heating and reasonably accurate heat controls is also an excellent source for processing hot melt vinyl 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 plastisol will speed the melting process. This second heat source could be infrared heaters or a heating coil. If this is not practicable to a certain application, a simple lid over the container being heated will prevent the molten surface of the plastisol from cooling.

### Master Mold Preparation

Molds can be made of any material that is not attacked by the plasticizers in the hot melt vinyl plastisol formulation. 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, un-fused 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 plastisol varies with the master type. A smooth metal master need only be preheated from 200°F (93°C) to 250°F (121°C) before pouring of the hot melt vinyl plastisol. 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 plastisol to the master. To protect the master from possible thermal shock damage when pouring the plastisol, preheat the master to 250°F (121°C).

### Plastisol Processing

The hot melt vinyl plastisol, as supplied, is a low viscosity liquid. Conversion is accomplished by heating the plastisol until the PVC 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 plastisol formulation, its hardness, and the process technique, but could vary from 330°F (166°C) upward.

As the hot melt vinyl plastisol warms in the vessel, it will begin to phase from a liquid to a solid at around 250°F (121°C). At this point, the plastisol can be visually described as a lump surrounded by liquid. The plastisol 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 vinyl plastisol be stirred during the heating process to assure more uniform heating of the mass. Additionally, the stirring of the plastisol will help break up the solid phase quicker.

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

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

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

### Pouring (Molten Plastisol)

Pouring the hot melt vinyl 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 with plastisol.

### Properties

Compounds of any color, including clear, can be utilized. Hardness values ranging from 8 Shore A (fishing lures) to 30 Shore A (casting molds) can be utilized. Surface feel (slimy to dry), chemical resistance, and other desired characteristics can be supplied upon request.

The plasticizers in hot melt vinyl plastisols are also plasticizers for other plastics and many materials used in paints and lacquers. Prolonged contact, with the part, can result in plasticizer migration with resultant marring or degradation. Often, proper compounding of the hot melt vinyl plastisol can prevent or reduce plasticizer migration.

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