Warpage injection molding

Contraction and Warpage Why Do They Occur? Contraction is an ion of the injection molding process. The contraction occurs because the polymer density varies from processing temperature to ambient temperature (see Special volume (PVT diagram)). During injection molding, the variation in contraction both worldwide and through the cross-sectional part creates internal stresses. These so-called residual voltages (see Residual stress) partially function, the effect of which is similar to external voltages. If the residual tensions induced during molding are high enough to exceed the structural integrity component, the part will melt after ejecting from the mold or crack the external service load. Contraction The contraction of the molded plastic parts may be not more than 20 % by volume measured at the processing temperature and at ambient temperature. Crystalline and semicrystalline materials are particularly prone to thermo-shrinking; amorphous material tends to shrink less. When crystalline materials are cooled below their transition temperature, molecules rank themselves in a more efficient way, forming crystals. On the other hand, the microstructure of amorphous materials does not change with a phase change. This difference causes crystalline and semi-crystalline materials with a larger difference between the melting phase and the solid (crystalline) phase. This is shown in Figure 1. We would like to point out that the cooling rate also influences the fast cooling of crystalline and semi-crystalline materials in BAT behavior. FIGURE 1: Bat curves of amorphous and crystalline polymers and the change in volume between the processing state (point A) and the volume change at room temperature and atmospheric pressure (point B). Note that when pressure increases, the specific volume decreases. The causes of excessive part contraction Excessive contraction, above acceptable levels, may be caused by the following factors. The contraction ratio to the thickness of several processing parameters and parts is schematically shown in Figure 2. Problems caused by partial contraction Of uncompensated volumetric contraction leads to either sink marks or gaps in the molding of the interior. Controlling part of contraction is important in part, mold and process design, especially in applications that require intense tolerance. Shrinkage, which leads to sink marks or gaps, can be reduced or eliminated by packing the cavity after filling. Also, mold design should take into account contraction in order to meet the part dimension. Part of the contraction predicted by C-MOLD provides a useful guideline for proper mold design. FIGURE 2: Processing and designing parameters that affect part of the contraction of the Warpage Warpage are distorted if the surfaces molded part do not follow the proposed shape design. Part of the warpage results molded-in residue tension, which in turn is caused by differential shrinkage material molded If the contraction of the entire part is uniform, the molding does not deform or melt, it just becomes smaller. However, achieving low and uniform contraction is a complex task because of the existence and interaction of many factors, such as molecular and fiber orientations, mold cooling, part and mold design, and process conditions. Warpage due to differential shrinkage warpage molded parts resulting from differential shrinkage. The variation in contraction can be caused by molecular and fiber orientation, temperature fluctuations within the molded part, and changing packaging, such as overpacking gates and underpacking in remote locations, or various pressure levels of material solidifying the entire part of the thickness. These reasons are described in more detail below. Differences in the differential de-ed and outstanding materials in filled and outstanding materials are shown in Figure 3. If contraction is differential and anisotropic throughout the part and part of the thickness, the inner stresses created can cause part of the warpage. Filled materials Fiber thermoplastics, strengthening fibers inhibit contraction due to their lower thermal contraction and greater modulation. Therefore, the fiber-filled materials shrink less along the direction in which the fibers lead (usually in the flow direction) compared to the contraction in the transverse direction. Similarly, particle-filled thermoplastics shrink much less than the outstanding grades. Outstanding materials, on the other hand, when the unfilled molded part contains a high molecular orientation, shrinks the contraction of the anisotropic, because the aligned chains shrink to a greater extent in the direction of orientation. Liquid crystal polymers Liquid crystal polymers (LCPs), a tightly ordered selfless structure, tends to exhibit anisotropic shrinkage. FIGURE 3: Differential shrinkage for both outstanding and filled materials Non-uniform mold cooling throughout part of the thickness Uneven cooling in the part and asymmetric cooling of the whole part of the thickness of the mold cavity and the core may also cause differential contraction. The material cools and shrinks inconsistently into the mold wall in the middle, causing warpage after ejection. FIGURE 4: Partial war sheet due to (a) uneven cooling in this respect, and (b) asymmetric cooling throughout part of the thickness. Part thickness variation Shrinkage increases when the wall thickness increases. Differential shrinking due to uneven wall thickness is the main cause of the partial war sheet of unreinforced thermoplastics. Specifically, different cooling speeds and crystallization levels usually occur in parts of the wall sections of different thicknesses. This causes the differential to shrink, resulting in a partial war sheet as shown in Figure 5 below. Higher volumetric contraction due to high crystallization levels in slow cooling areas (e.g. thick sections) leads to differential shrinkage and thus part warpage Part geometry asymmetry or curvature Geometric asymmetry (eg a plate with a large number of ribs aligned in one or one part) leads to uneven cooling and differential de-cooling, which may cause a partial war sheet as shown in Figure 6 below. Poor cooling of mold on the wall ribbed side causes slower cooling of the material that on one side, which can cause part of the warpage All Injection molding defects>Dissolving molding warpage problems The definition of Warpage occurs when there are variations of the inner stresses of the material caused by variation contraction. Warped parts may not be functional or visually acceptable. Causing uneven cooling Temperature differences from one side of the mold to the other can cause layers to freeze and shrink at different times and creating internal tension. Inconsistent contraction Resulting from: (a) Material variations such as property variations, different moisture content, inconsistent melting and pigmentation; (b) fluctuations in process conditions, such as inconsistent packaging and different mold and melting temperatures; (c) Machine variations such as a damaged control ring and an unstable controller. (Animations are not available More...) Remedies reduce differential contraction to minimize orientation effects of position gates with one-way flow and change the portion thickness. Change the part geometry of the add features such as stiffness of the ribs design. Change part of the design to avoid thick sections and reduce the thickness of any features that intersect the main surface. Use thinner wall sections of the ribs to thicken only those wall sections that require additional material structural stability and which cannot be strengthened using another method. Change material semicrystalline is of course a larger contraction and thus is more prone to warpage. Solving one problem can often lead to other problems in the injection molding process. Each option therefore requires consideration of all relevant aspects of the mold design specification. What type of part is going to cause a war party? 1: If the part is molded PP, HDPE, PA, POM. Parts of plastic are easy to cause warpage. 2: Most litter ribbers. 3: Unreasonable part of the design causes molding of militant or deformation. If you need a high quality injection of mold, contact us. Warpage is a problem issue, a serious warpage causes fairlure part. Viewmold companies engineering team has been studying warpage for 10 years, and found some warpage is caused by unreasonable parts design, injection mold design or unreasonable injection molding condition. In 2018, our injection molding testing team found that most warpage can be improved by adjusting the injection molding condition. Pressure pain, injection pain time, hold molding pressure, cooling time, step, mold temperature and ejection are keys. Sometimes an extra cooling time can improve the war sheet, but this causes additional production costs. We will do our best to avoid a solution. If you have a larger share of or deformation risk that require injection molding services, please cotact us sales@viewmold.com Our companies also offer injection mold design services, and an injection mold design engineering team will help you avoid warpage risk. Injection molding air trap issue and solution Injection molding fragile issue and solution Injection molding burn issue and solution Injection molding crack issue and solution Injection molding delamination issue and solution Injection molding dimensions variation issue and solution Injection molding discoloration issue and solution Molding molding excess part weight and solution Injection molding fish eye issue and solution Injection molding flash issue and solution Injection molding follow the line and solution Molding hesitancy question and solution Injection molding high volume contraction issue and solution Injection molding jets issue and solution Injection molding overpacking issue and solution Injection molding racetrack effect issue and solution Injection Molding subpacking issue and solution Injection Molding subpacking issue and solution Injection Molding

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