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MOLD SHRINKAGE

TECHNICAL ARTICLES | PROPERTIES OF PLASTICS

When designing injection molded plastic parts, dimensional accuracy can be critical to part fit and functionality. One variable that can affect part dimensions is the amount of shrink that occurs during and after the molding process.

Mold shrinkage is defined as the change in dimension between the dimension of the mold cavity and the solidified molded part 24 hours after it was ejected from the mold [1]. Whereas, post-mold shrinkage refers to the contraction of the solidified and ejected molded part after the relaxation of molded-in stresses.

- Factors that contribute to mold shrinkage are numerous and include:
- Resin structure; e.g. degree of crystallinity, amorphous
- Flow of the resin in the mold; e.g. gate location, tool design
- Additives in the resin that change molding characteristics
- Processing settings; e.g. injection pressure, pressure hold time
- Temperature of the molded resin

Generally, resins that are crystalline have more inherent shrinkage than amorphous resins. This is due to the very definition of what it means to be crystalline: highly ordered microstructure; which causes the molecules to come very close (relatively) to one another when compared to an amorphous microstructure.

Orientation of the resin molecules also has an effect on shrink. Shrinkage is less in the flow direction as compared to the cross flow direction [2].

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Additives to the resin, such as glass, help mitigate shrink. The additives prevent the ordering nature of the plastic, which prevents them from coming in close contact with each other. Thus, this keeps the molecules spread out and lowers the shrinkage.

The next article will discuss other aspects of the injection molding process that affects shrink and review a real life example.

[1] Campo, E. Alfredo, *The Complete Part Design Handbook*, Hanser, 2006.
[2] Strong, A. Brent, *Plastics: Materials and Processing*, Prentice Hall, 2000.

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