Plastic Sandwich

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Introduction

Molders who use conventional injection molding machines should ask themselves this question. Why spend 25 percent more money than necessary? A co-injection system called Twinshot, will save a molder 25 percent on resin costs by using regrind, off-spec, or recycled material as core filler, while still producing the same higher quality part (Twinshot Defined… 2003). Also, there is no need to replace the existing injection molding machines because the Twinshot co-injection system can be retro-fitted. It is as simple as a routine barrel change. With these advantages over conventional injection molding, there is no reason not to make the transition to Twinshot co-injection.

Co-Injection Background

The co-injection molding process is similar to conventional injection molding, except for one major difference. Co-injection uses a special valve configuration that enables two separate injection units to inject chemically compatible plastics through the same injection port. This process allows one material, usually the prime or virgin material, to form the outer skin of the part while a second material fills the center. Generally, the center (or core material) is a recycled, unpigmented, off-spec, or foamed resin material. Co-injection offers many cost saving and design benefits over the conventional injection molding process. These benefits include the ability to mold larger parts with less clamping pressure, reduced material costs, and the elimination of painted glass filled parts. Co-injection also aids the molder looking to make value-added products such as soft-touch parts or parts with a cosmetic surface over a glass-reinforced core.

What is Twinshot?

The process of co-injection molding uses only a single-screw and a single-barrel unit. This process, developed by Twinshot technologies, is making its way into the industry. John Rhodes, Twinshot Product Manager, states, "Injection molders throughout the world expressed an overwhelming interest in Twinshot upon seeing the technology demonstrated at the recently completed K-Show" (Retrofit Market License).

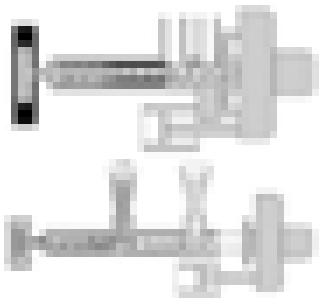
It is a design that can be retro-fitted to any conventional molding machine with little initial investment, still having the capabilities to inject just a single material. Unlike previous co-injection machines, Twinshot has a single conventional barrel design. The unit was designed with a solid screw enclosed within a second, hollow screw (Mapleston, 2002). Each screw independently processes a different melt stream. The melt stream is pooled in a common section of the barrel in front of the screws, with one material accumulating first,

then the second. Then the pool of layered melts is injected into the mold in one stroke. The well-known principle of fountain flow causes one material to cool against the mold walls and the other material to form the encapsulated core during the injection process. The all-in-one injection is significantly faster than other co-injection processes that inject materials separately.

The design requires no changes to the screw drive mechanism, new hydraulic requirements, software, manifolding, gate valves, new controls, or support equipment. In fact, this technology requires less floor space and uses less energy than a conventional co-injection system. The injection of both materials at the same time, from the same unit, eliminates timing problems. "Recovery time is much quicker, even faster than an equivalent conventional screw, because both materials extrude simultaneously," said Joel Thompson, inventor of the process (Rose, 2002). Conventional co-injection machines have to time each shot carefully; they cannot inject multiple materials at the same time. Also, the manifold is eliminated so there is no melt pressure loss, velocity, and shot size control. Further advantages of the Twinshot Version II include:

- Faster recovery, since both materials plasticize simultaneously.
- A broader range of screw sizes.
- Lower cost, since there is only one screw rather than two.
- A wider range of material combinations, using independent temperature control on the two materials.
- Production of soft-touch parts in a single molding operation.
- Easy conversion to single-material mode by supplying the same material to all feeder hoppers.
- An inner oxygen-barrier layer in packaging applications.

Twinshot Version II
This illustration shows the unit has one screw processing two materials.



Using Recycle

Material

The use of post-consumer recycled material as the core of a product can result in a huge savings in material costs (depending on the size of the operation). Because the material will be imbedded in a virgin material, there is no worry about possible contamination of foreign objects or irregular color tones.

In today's environmentally conscious world, using recycled material is almost a must and the Twinshot system encourages it.

Increasing Appearance

When high glass content is required to meet stiffness requirements, painting the parts is usually necessary to achieve a high gloss. With Twinshot co-injection, the glass filled plastic is injected in the center and the non-filled resin is injected at the skin (Co-injection Produces). This creates a part with a resin rich surface, which requires no painting. Comparing that to a mono-layer conventional injection mold, it eliminates steps while improving the quality of the product, saving time and money.

Another Co-injection Method

There is another type of co-injection system currently being used in the packaging industry, a system that uses two different barrels to inject each material. The barrels are joined together by a common manifold and nozzle, through which both materials flow before entering the cavity. The nozzles are designed with a shut off feature that allows only one of the materials to flow through at any given time. To set up the process, the percentage of skin to core material is determined, and the two barrels are each programmed with the appropriate shot size. Barrel A generally holds the skin material and injects the set amount of polymer into the mold. This is followed by the core material in barrel B that penetrates the skin polymer and completes filling the cavity without breaking through to the skin surface. In the third stage, a small amount of skin material completes the injection, which completely encapsulates the core materials. However, this three stage process can be accomplished in just one simple step with a Twinshot system, thus increasing production speeds.

Cost Savings

Material savings are probably the biggest benefit of any co-injection technology, and Twinshot is no exception (Knights, 2003). The single greatest expense for custom molders is material costs and Twinshot has been proven to reduce these costs by 25 percent or more. Twinshot can usually replace up to 35 percent of a part's weight with lower cost material in the core. Molding parts with a core of recycled material that constitutes 30 percent of the part can save a molder approximately $42,000 a year by using a commodity resin. The cost of the entire system, retro-fitted to a conventional molding machine, should only cost about 20 percent of the total machine. One conventional co-injection machine costs around $270,000 versus a conventional molding machine with a retro-fitted Twinshot system at $200,000 (Knights, 2003). A conventional co-injection machine can take anywhere from five to seven years to pay off and a Twinshot co-injection system will be paid back within a year (Twinshot Defined, 2003). This will lower a company's overhead by $70,000 per machine. By simply looking at cost alone, there is no question as to what type of system to use. Also, higher quality parts will be produced at greater production speeds.

Why not Use Conventional Injection Molding?

Using a mono-layer injection molding machine, one can get a multi-layer product. However, it is a two step process that will not produce a quality product like a Twinshot co-injection system would. First, one material is injected into the mold. That mold is then transferred to another machine where the second material is injected. When producing parts on two different injection machines, bonding between the two materials is not apt to be as good as on a Twinshot machine. Even when using compatible materials, the delay time may cause the first shot to be too cold. Plus, any dust or dirt picked up during the transfer will negatively affect the bonding process of the two materials (Ehritt, 2002). Delaminating of material will probably occur, leaving a defective product. Therefore, using a Twinshot co-injection system will produce much better products and ultimately make the company more money by increased sales and production. Twinshot co-injection molding systems can produce a wide variety of products that will perform better, cost less, and be more aesthetically pleasing for consumers.

Conclusion

Molders should consider switching from conventional injection molding to co-injection molding using the Twinshot system. Commodity resin alone will result in a net savings per year of $42,171.60 (Twinshot Defined, 2003). It will not only save money on material costs by using regrind, off-spec, and recycled material as a core filler, but it will also reduce overhead costs because the Twinshot system is 30 percent less expensive than a conventional co-injection machine. Also, the Twinshot system is easier to install and is more user friendly. With the combination of increased production speeds, reduced resin costs, and reduced overhead costs, the Twinshot co-injection system should be a consideration that every molder makes.

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