Thermal Molding of Injection Molds Boosts Surface Quality

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In the injection molding process, tool temperature is an important factor in achieving high-quality parts. It is generally believed that higher tool temperature often results in a better surface quality. However, molding tool temperature is also an essential variable to consider. For example, the molding machine should be set at a higher temperature to reduce the melt temperature of the material to be injected into the mold. Higher tool temperature can also be used to reduce visible molder marks, which are usually caused by the interaction between the two surfaces. However, it is also important to note that if the tool temperature is too high, it can lead to warping or distortion of the molded part, which can negatively impact the surface quality.

SABIC Innovative Plastics

SABIC Innovative Plastics began working on this technology in Japan several years ago. The company's vision was to develop an automotive tool that could be rapidly manufactured, cost-effective, and easy to maintain. The resulting tool is a highly versatile and cost-effective tool that can be used for various applications, including the production of automotive parts.

SABIC Innovative Plastics believes that the use of advanced technologies is crucial to achieving high-quality parts. The company's approach involves the use of computer-aided design (CAD) and computer-aided manufacturing (CAM) tools to create highly accurate and efficient tool designs. The company also emphasizes the importance of quality control and continuous improvement to ensure that all parts are manufactured to the highest standards.

HOT WORKS

Conventional injection molding machinery can be used for hot-work processing. However, a special auxiliary system is required for heating and cooling the mold surface. This system typically uses air or water to generate steam, which is contained within the control unit itself. It is a feature that makes SABIC Innovative Plastics unique, as they offer an integrated solution that includes both the mold and the auxiliary system. The company's approach to mold design is to create a modular system that can be easily adapted to different applications. This modular design approach allows for flexibility and customization, which are essential in the automotive industry.

For efficient process control, the mold must be equipped with thermocouples that are close to the mold surface to monitor the temperature. The injection mold, the mold cavity, and the hot-work controller must be integrated to achieve a stable process. During the development of the process with SABIC Innovative Plastics, they built our own control unit to integrate each element.

Focus on Tool Design

The effect of hot-work technology on overall cycle time depends on the materials being processed and, more importantly, on the design and construction of the tool. The time required to heat and cool the mold tool is a function of the volume of the material to be injected. For example, if the mold is used to inject a small volume of plastic, the cycle time will be shorter than if the mold is used to inject a larger volume.

Several different designs are used to achieve conformal cooling, such as laser ablation and direct metal deposition. For a test mold, SABIC Innovative Plastics used a metal-based material, which is primarily used for its conformal cooling properties. The technology builds the mold from a metal layer by layer, which is then cut and sanded with copper. This method yields a conformal and "fused" cooling channel, as well as extensive venting, at low cost.

Benefits

Heat/cool technology can significantly enhance the life of injection molded parts. The improvement is more dramatic for parts made of structural aluminum, die-cast, and blends like PC/ABS and PC/PBT. When the mold temperature is controlled, the tool can be heated or cooled to reduce the part temperature, which can improve the surface quality and reduce warping.

For filled materials, a thin layer of polymer on the outside surface encapsulates the filler, thereby increasing the rigidity and reducing the tool temperature. SABIC Innovative Plastics uses this technology to improve the surface quality of molded parts. The company's approach involves the use of advanced technologies, such as computer-aided design (CAD) and computer-aided manufacturing (CAM) tools, to create highly accurate and efficient mold designs. The company also emphasizes the importance of quality control and continuous improvement to ensure that all parts are manufactured to the highest standards.