



Tool Design for Glass-Filled Materials

When designing a mold that will run a glass-filled (GF) material, more attention to erosion, venting, and cooling are necessary. These issues are important with all materials, but GF materials require design changes to address them. Most of my experience with GF materials is with nylon, PP, and Noryl (PPE alloy). Erosion can be addressed with the tool steel, coatings, and surface hardening. The volume of parts expected to run will also affect the choice of steel to minimize erosion. Hardened tool steels such as H-13, S-7, and stainless steel are preferred for tools that will run a high volume of parts, but they do increase the cost of the tool. P-20 tool steels can have coatings applied or have the surface hardened to minimize erosion while keeping the initial cost down. But hardened tool steels allow a quicker turnaround time and lower cost when it comes to repairing eventual erosion and other damage. When you have coatings or surface hardening, the repair can take much longer and the costs will be higher.

Tool erosion typically comes from two different causes - the glass content and lack of venting. The tool steel, coating, or surface treatment will address the erosion from the glass content. But with GF materials, venting is much more critical to address erosion because they are typically more gassy. Venting ribs, details, knit lines, and the parting line at any point where there is a gas trap is critical.

During the initial tool design, it can be difficult to know where these gas traps will occur, but flow simulation software has gotten better at predicting them. Flow simulation (mold analysis) is an added cost up front, but it can reduce the amount of rework on venting after the tool is built. (Venting is a major subject in and of itself and a weak area in the industry).

More Cooling, Less Sticking

Cooling is also more critical with GF materials, especially nylons and PPE alloys, to address cycle time and sticking issues. If I ever have sprue sticking with GF materials, it typically results from insufficient cooling in the sprue area. (On the other hand, PP at times actually sticks less as the tool warms up.) You will need to be more creative on tools running GF materials in finding ways to add cooling in certain areas to reduce cycle times, part blowouts, and other quality issues. We have probably all heard someone say, 'We can't get water in there,' but where there's a will, there's a way.

Too Smooth Can Be Trouble

Tool and part surface finishes can also contribute to molding. Most of the time when there is a sticking problem, tool shops will polish the mold surface. With some materials this will make things even worse. Most TPU, TPE, and TPO resins prefer a blasted or textured surface, but depending on the durometer, that is not always the case. Some react better to an aluminum oxide finish, some to glass bead, and some to a draw polish.

PP is another material that will stick to a highly polished surface - it acts like a suction cup. I have found a 320 or 400 paper draw polish is best in this case. PC can also stick to highly polished surfaces. There are also some coatings that can be applied to assist with release.

Gating and runner sizes are areas that are material-specific as well. I have found that the industry does not have really any good standards when it comes to this. There are so many variables with regard to flow length and wall thickness that can impact gate and runner sizes. Some materials prefer smaller gates to produce shear for easier flow, and some filled materials need larger gates. As noted in last month's column, the gate geometry alone can have a huge impact on scrap and cycle time.

There is also a lot of waste in the industry due to excessive runner sizes. I have found this is an area that lacks research and is not open to easy generalization.

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