



Cycletime Tips - Automotive

Volume 43: Screw Inertia Awareness

As injection molding processors, we've been advised that faster fill rates will allow for a more repeatable process, less residual stress and a more efficient process. These facts cannot be disputed with any credibility. An underlying excuse for filling slowly is confronted very frequently during my travels and is worth addressing as it has made the difference between a well-running mold and a mold that is deemed a "problem child." Many individuals have made the mistake of ignoring something called *Screw Inertia* when initially sampling molds and have unnecessarily lengthened tool development times as a result of it.

Inertia is roughly defined as one-half of the mass multiplied by the velocity which is squared ($I = \frac{1}{2} mV^2$). In other words, as we begin to push the screw forward at an elevated rate, the effective inertia changes significantly. As the fill rate is increased, the amount of "overshoot" (uncontrolled screw movement beyond first stage cutoff) that may occur, changes exponentially. This combined with the inherent non-Newtonian behavior that polymers exhibit can result in a misguided opinion that fast filling only damages molds.

The following scenario is repeated more often than I'd like to admit. A new mold is sent to a sample shop for first shots. After the mold has been carefully placed in a capable (or not) machine, the resident processor plugs in the appropriate temperature variables and begins the attempt to produce good parts. Being afraid of damaging the mold, he or she proceeds to fill the part very gently in order to avoid flashing. As they "sneak-up" on filling the cavity, eventually a full part is placed in your hand. At that point, we begin to scrutinize the tool.

Little did the processor know, their unsound strategy might have produced warpage due to unseen molded-in stress levels, short ribs, and/or poor knit lines. We then begin to pursue the drawn-out tooling compensation mode in order to combat them. In past tech tips and training seminars, we have hashed and re-hashed the idea of optimizing first stage injection rates to avoid such things.

When attending mold trials such as the one described above, it would be wise to explore several filling speeds (with no follow-up pack and hold pressures) to determine what velocity makes the most sense for your part. If we provide an estimation of shot volume before the sample is initiated, we will avoid much of the fear associated with fast mold filling and cavity over-pressurization. This proactive step coupled with some knowledge of the value of expedited injection rates has proven itself time and time again as a problem solver. Please let us know if you require more information on this topic.

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