High Volume Bioabsorbable Micro Component Production

How to Ramp Up Production While Decreasing Piece Part Price

When Higher Cavitation Doesn't Result in Lower Cost

When OEMs prepare to increase production volume of a micromolded component, many focus on multi-cavitation tooling as a strategy to reduce piece part price. While increasing cavitation may be a cost-effective approach for higher volumes of simple thermoplastic parts, it is typically not the best approach for micromolded parts, especially those that are bioabsorbable, or made from other high dollar value materials.

This may initially seem counter-intuitive.

MATERIAL WASTE

Figure 1 shows an example of optimized micro runner system designs that can be utilized for any material. You can see that the inherent material waste is in simple surface area. With expensive materials like bioabsorbable resins, which can cost $5-10 per gram, it's easy to see how this amount of waste results in a non-cost savings situation.

In micro molding, it's estimated that a runner-to-part ratio for an optimized 1-cavity design is about 80:1. For an 8-cavity, it's an estimated 800:1. An 80:1 ratio may seem like the runner is big and wasteful, but the reality is the majority of the material will always live in the sprue and runner, because the micro parts they are feeding are extremely small in comparison.

INCREASED CYCLE TIME

When increasing from a 4-cavity to an 8-cavity runner system design, one may assume that you'd double the yield. But in reality it takes longer for the molding process to create an 8-cavity shot — about 10–15% longer cycle than a 4-cavity version.

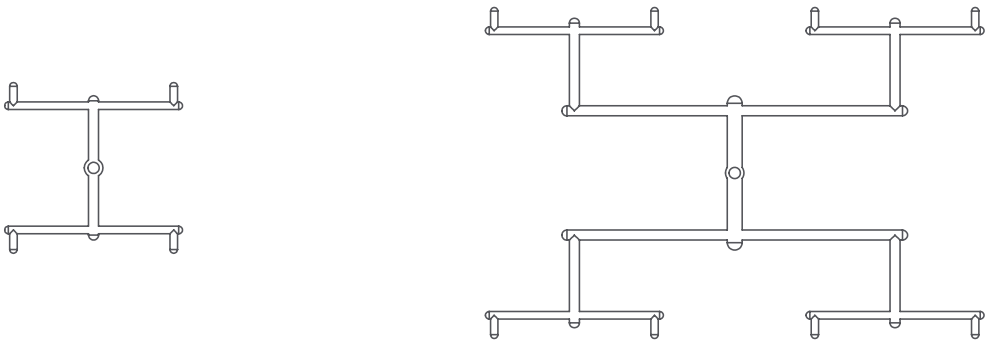

FIG. 1: Above are examples of 4-cavity and 8-cavity runner systems. While the exact cavity spacing layout and subsequent runner size is very dependent on part geometry, you can see the 8-cavity runner size is more than twice that of the 4-cavity runner. In this particular example, the 8-cavity runner size was 2.75 times the size of the 4-cavity.

MOLD & AUTOMATION ISSUES

Complex, tightly-toleranced micro designs lend themselves best to smaller cavitation tooling. With hundreds of variables to control in micro molding, introducing higher cavitation can further expose the molding process to risk. And risk is expensive.

Hidden costs of high cavitation micro molds are a result of significantly more time and resources being spent on hard-to-avoid issues like more frequent repairs, maintenance and downtime.

The automation complexity increases with more cavities as well. Having a robot successfully and accurately remove a tiny, fragile part from a 1-cavity mold, present the part to multiple camera systems, and dispense the part into a custom packaging solution is a feat in itself in micro molding. That challenge gets compounded significantly with more cavities.

4 Key Areas for Savings

With high cavitation tooling not being an ideal cost-savings option for micromolding, and especially for bioabsorbable products, how can piece part pricing effectively be reduced with production volume ramp up?

We recommend focusing on the following four areas to bring the piece part down for bioabsorbable products:

1. RUNNER SIZING

Use runner optimization to pinpoint the minimal amount of material required for the runner system to be successful. MTD's MicroRunner tool has a ratcheting runner system that varies in diameter and aids in determining the minimum runner size required to fill the volume of your part with the goal of sizing a runner system to adequately mold a product without sacrificing material.

2. PRODUCTION OPTIMIZATION

Having a successful molding optimization period during early production helps with planning and efficiency, which can result in cost savings down the line.

3. ACCURATE FORECASTING, STEADY ORDERING

Accurate forecasting, blanket purchase orders, and steady ordering can allow the molder and material provider to be more efficient with their processes, resulting in less manufacturing costs, and piece part cost savings passed down to the customer.

For example, MTD was able to reduce a bioabsorbable piece part price with steady ordering and accurate growth forecasts by **40%** over a five-year span.

4. RISK MITIGATION STRATEGY

Designing the validation protocol to validate the widest range of bioabsorbable material IV lots available is a risk mitigation approach that could result in cost savings for the product.

By validating the widest IV range possible, and passing the validation, the molder will be able to successfully accept and process any IV lot in that range. This reduces the risk of interrupted production runs that would be inevitable if only a single IV lot was validated and those lots became unavailable during production. That would require additional costs to get the production line back up and running with new IV lots, as well as further activities to validate.

4 Steps to Scaling Your Program

The path we encourage our customers to take when they are starting a challenging bioabsorbable R&D project is to always start at proof of concept and scale the program using the following steps:

STEP 1 Prove the design is viable.

STEP 2 Create a prototype mold that can be used for early production.

STEP 3 Maximize cavitation based on what you learn from that prototype tool.

STEP 4 Build production cavities at optimum cavitation to reduce cost, and then consider multiple molds to achieve your volume requirement.