

MTD's MicroSeries™: The Scientific Approach to Micromolding

Background

The micro-world is a very different place. When distances are measured in microns (0.00004"), and when a single pellet of raw plastic can produce literally dozens of individual finished parts, many of the macro-world's accepted conditions and interactions just do not apply, especially when complicated by challenging materials such as PEEK, ULTEM, or the fragile and expensive new entries in the Bioresorbable field. This is the world where MTD lives, and where the company works daily on the "Edge of Science"™ to expand the frontiers of injection molding knowledge of the Microworld.



FIG. 1: Above is a Micromolded tack placed in the corner of a standard U.S. postage stamp. In the Microworld, both the physical size of the part, as well as the physical size of the features on the part (see the two barbs protruding from the center shaft), are relevant.

Identifying the Problem

In Micromolding, the overall part size is very small, and indeed small part size is one of the most recognizable features of Micromolded parts. In MTD's case, the maximum overall size of parts is less than a standard postage stamp.

However, small part size is not the end of the story. Even smaller feature sizes (with yet smaller dimensional tolerances) almost always exist on these parts, and herein lies one of the most difficult hurdles of all in Micromolding:

- Q:** How do we design parts and molds such that the molding process can be engineered to make the molten plastic "fill" those small features?
- A:** (a) Plan ahead, (b) be flexible in design so that (c) special design and processing approaches can be employed and (d) choose a material with processing in mind just as much as finished part mechanical characteristics, and (e) take full advantage of systems such as MTD's MicroSeries™.

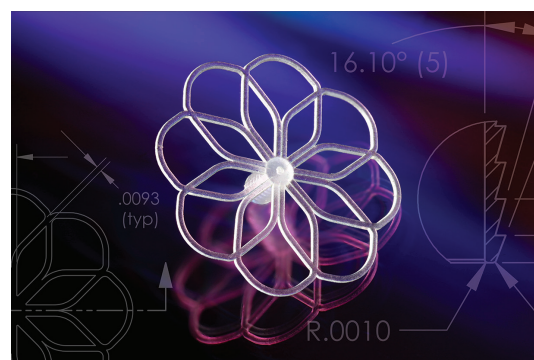


FIG. 2: Above is a Micromolded cardio surgical catheter tipped ablation head. It is approximately 0.300" in diameter and molded in an experimental shape-memory material so that the "flower" design can collapse or spread as shown above. From a molding standpoint, the long, looping channels provide multiple, intersecting flow paths, and preventing 1 or more of these channels from prematurely solidifying and causing a "short-

shot” would be a challenge in macro-molding, let alone Micromolding.

The Solution: MTD MicroSeries™

The MTD MicroSeries™ is a collection of 40 years of experienced-based information involving Micromolding tooling and manufacturing variables. This proprietary know-how has been assembled into a grouping of 13 elements. When joined together, the 13 elements are called The MTD MicroSeries™, which consists of the following:

THE 6 SCIENCES:

“The 6 Sciences” are the basics providing the understandings and knowledge of “all things micro”. These elements provide the foundation which supports everything MTD does in the Microworld:

- Micro-Material Science
- Micro-Part Design
- Micro-Tooling Capabilities
- Micro-Molding
- Micro-Metrology
- Micro-Material Handling

THE 3 TECHNOLOGIES:

The “3 Technologies” are a body of know-how, techniques, process controls, and so forth which helps MTD convert Science into Engineering. They are:

- MicroFlow™ Science of materials and flow
- MicroFill™ Science of micro-rheology
- MicroEdge™ Science of thin edges and controlled “flashing”

THE 4 CUSTOMIZATIONS:

The “4 Customizations” are the manifestation of the engineering elements into manufacturing hardware and practice:

- Customized Toolmaking Capability
- Customized Injection Molding Machines
- Customized 100% Automated Inspection
- Customized Material Handling Systems

Customer Benefits: Example

This powerful suite of technologies and know-how affords customers the benefits of creating designs which previously were not producible. Furthermore, the scientific understandings support the engineering practices leading to manufacturing repeatability, process optimization, and ultimately, world-class value.

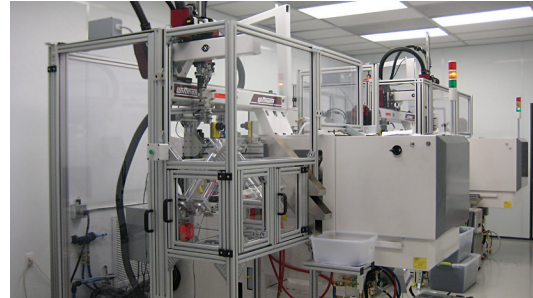


FIG. 3: MTD MicroSeries™ manufacturing is fully isolated and completely controlled. Each work cell is self-contained and resides in a Class 8 Cleanroom. Each cell is equipped with a customized optical measurement system feeding a computerized data collection and analysis system. All part movements are designed to take advantage of precision automated material handling robotic systems, and parts are never handled manually.

Summary

Successful Micromolding relies on a balanced combination of specialized technologies and customized equipment, of which MTDs 13-Element MicroSeries™ is an excellent example. The customer benefits are increased design freedom, improved manufacturing reliability, and world-class value.

Helping to Improve Life.