

MTD Leads Micromolding Material Science

12 Years of Developing Micromolding Processes for Bioresorbable Materials

Background

The world of “micro manufacturing” challenges the creation of micro-injection molded parts from nearly every perspective. The notion that Micromolding requires highly specialized tooling and specialized molding processes, seems logical to both experts and newcomers alike, however, very little is understood about an area which can have just as much impact on the success of Micromolded parts as tooling and processing. This area is “Micro-material Science,” and as important as it is in highly engineered “permanent” materials such as PEEK, it has a hidden, long-term significance for fragile Bioresorbable materials, too.

Identifying the Problem

From the end-customer’s perspective, the most severe micromolding problems involving Bioresorbable materials manifest themselves as variable performance properties in the molded parts. To compound the frustration, solving this problem can involve performance failures which shift from lot to lot, and even within lots. Often this prompts micromolders to want to respond with design changes in the part. The design, however, might not be the entire problem. MTD has observed that many times the material suffers degradation BEFORE it starts to form the part. In these cases, the erratic performance will be built into the part from the beginning, usually due to aggressive processing parameters such as elevated temperatures, long residence times, high pressures, severe pressure drops, as well as extreme surface area to part volume ratios.

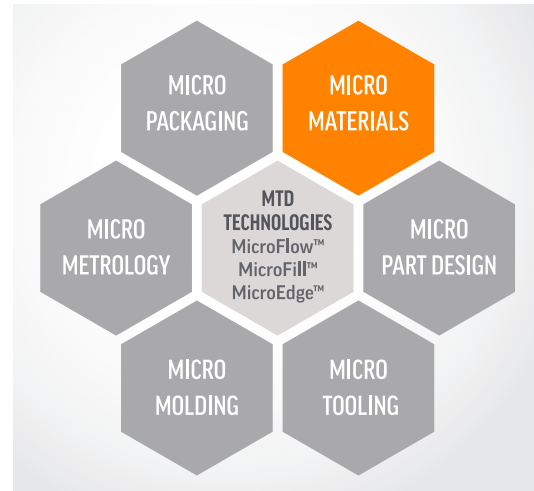


FIG. 1: Above is the MTD Interconnected MicroSeries™ of “6 Sciences”. The Micro-Material Science hex cell in the “1 o’clock” position is the customary MTD starting point in considering any new project

The Solution: MTD Micro-Material Science

Often the key to the successful function of a finished molded part hinges on maintaining the integrity of the material from which the part is made. Simply stated, success is improved when the material is not degraded.

IV LOSS ≤ 6%

FIG. 2: While many material suppliers and molding machine manufacturers recommend Inherent Viscosity¹ (IV) losses in the 20% and higher ranges, MTD has learned to consistently limit this loss in many cases to 6% or less. The link between material properties and material molecular weight is well known², and in MTD’s 12 years’ experience, molding techniques have been developed which repeatedly realize a minimal IV loss, usually less than 6%.

The MTD analysis of material performance involves several steps. Using MTD-designed and manufactured test molds, a series of molding trials forms various part geometries that can then be laboratory tested at MTD. In the end, the most useful units of measure for MTD are the Inherent Viscosity laboratory test results which help determine the material degradation introduced during the Micromolding process. While MTD targets IV losses for many materials at, or less than, 6% most competitors and machine manufacturers have difficulty realizing less than a 20% IV loss, and some go many times higher.

Knowing this limit, though, is much easier than achieving it. To move this understanding into application requires a thorough understanding of the other “5 Sciences” (see Fig. 1, above), ranging from Micro-Part Design to Micro-Material Handling and Packaging. Also necessary are the Micro-systems and hardware to achieve “low IV loss.”



FIG. 3: “Some of best Micromolding work we do is performed in the laboratory.” MTD has learned that a “Flawless Launch” requires a complete understanding of the behavior of each material as it responds during the molding process. This is especially true for fragile materials like those in the Bioresorbable family, or permanent resins which are otherwise challenging, like PEEK.

Customer Benefits: Example

Highly engineered materials, Bioresorbable materials in particular, are very expensive. For that reason customers are not eager to pay for wasted materials, as well as for extended development times, in order to educate their Micromolding suppliers. MTD’s experience and scientific approach to Micro-Material Science provide solutions not available elsewhere.

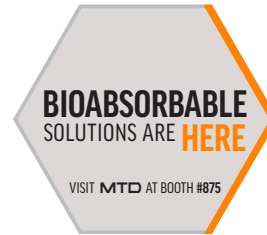


FIG. 4: This sticker commemorated the 12 years MTD had been developing Micromolding processes for Bioresorbable Material and was distributed at the 2014 MD&M East Show in New York City

Summary

Perfect Micromolded parts start with a complete understanding of the material being molded, whether it is a permanent resin or a Bioresorbable material. In either case, MTD is an experienced solution provider who knows the importance of, and has the techniques for, limiting material degradation.

Expanding the Edge of Science in Micromolding

¹ Inherent Viscosity: Intertek Plastics Technology Laboratories; www.ptli.com/testlopedia/tests/iv-d2857.asp

² Introduction to Polymers; R.J. Young

See a comprehensive list of available MTD Materials at: www.mtdmicromolding.com/sites/default/files/docs/MTDmaterialsFlyer.pdf