Home (https://www.accu-mold.com/) » What is Micro Molding?

What is Micro Molding?

Micro-molding is a highly specialized manufacturing process that produces extremely small, high-precision thermoplastic parts and components with micron tolerances.

The micro molding process starts in a tooling department where a mold is created that has a cavity in the shape of the part desired. Thermoplastic or resin (https://www.accumold.com/micro-moldingcapabilities/materialselection/) is rapidly injected into the cavity, creating the component or part at high speed.



Accumold Micro Molding examples



Micro Molding Definition

For clarity, we will spell it "micro molding" but elsewhere you may see it spelled micromolding or even micro moulding for our European friends. Spelling aside, interest in this art has dramatically increased in engineering circles, especially in the last decade.

The rise of micro molding is due to increased interest from designers and manufacturers producing smaller, lighter, and more precise devices and specialized equipments. In order to miniaturize technology, OEMs must first procure high precision, micro-featured plastic parts.

So, what is micro molding and how is it different from molding small parts? Part size is an obvious factor, but not the only factor that matters. True micro molding produces a component or part that is:

- micro in size
- micro in features
- micro in tolerances.

Accumold believes micro molding involves much more than overall part size, extending into geometry, complexity and tolerances. And what better way to explain and show off than a cheeky video with our VP of Customer Strategy, Aaron Johnson?

Watch the video



Does 3D Printing or Nano-Printing count?

Obviously, the term "micro" suggests that micro-molding has something to do with size, but there is a lot of nuance in micro molding.

While it might be true a part that weighs less than a gram was micro molded, there's more to it. Many molders can actually produce small parts, or even 3D print them. (More on that later) Where the traditional process and 3D printing struggle however, is in efficiently and precisely molding a part millions, or billions of times in rapid succession without any quality degradation.

Can't Anyone Buy A Micro Molding Machine?

What Is Micro Molding?

Today anyone can buy an injection press from a variety of manufactures advertised as a "micro molding" machine. While we wouldn't consider these presses sufficient to produce a true micro injection molded component, there's another misconception few people understand: a micro molder is not classified by hardware.

The combination of technique learned over decades, processing, and expert tool building all come together to accomplish true micro molding. In the same way buying a Steinway (https://www.steinway.com/) doesn't produce great music, buying a micro mold press off the floor doesn't produce great micro mold parts. It takes years of experience to become a virtuoso in both fields.

Small Parts May Also Require Micron Tolerances

Not every application requires the overall part to be microscopic. Many OEMs have small mold projects that require complex and detailed geometry and tight tolerances. For example, a part measuring about an inch long can have many micro-sized features, like a 0.004" (0.1mm) thin wall section or a 0.008" (0.20mm) diameter hole. These features are too complex for a small injection molder, but these are comfortably in the wheelhouse of a micro-molder. Micro molders apply the skills and expertise from successful micro-molding to these "larger" parts.

Micro Mold Classifications



(http://www.accu-mold.com/wp-

content/uploads/2015/12/lead-frame-molding.jpg) Lead Frame Micro molding Micro molding complexity doesn't stop at injecting molten resin into a cavity to produce a part. Most customers have demands that include inserting material into the part like lenses or fabric, and others require multiple resins and plastics to be injection molded together, forming one part.

We classify these more complex parts into three categories. Insert or lead frame, 2-shot, and micro optics.

Insert and Lead Frame Micro Molding

The demand for micro-sized lead frame and insert molding continues to grow and the same size and tolerance requirements of standard micro-molding apply to these processes as well.



(http://www.accu-mold.com/wp-

content/uploads/2015/12/micro-insert-molding.jpg) Micro Insert Molding

The ability to overmold a micro-sized part on an extremely small insert while maintaining consistency and accuracy is critical. This process is in high demand especially in the micro-electronics and semiconductor industries.

Insert micro-molding is capable of molding in and around a wide variety of materials such as ceramic, glass, fabrics, film or foil—even other plastics.

The image to the right is an example insert molding on the microscale. This particular example shows a special fabric insert material carefully positioned at the center of the part.

To successfully feed, cut, position and shut-off on this unstable and delicate material, the mold has to be very precise. In this particular case, the molding process required repeatable control to avoid damaging the insert while keeping the tight tolerances of the part itself.

2-Shot Micro Molding



(http://www.accu-mold.com/wp-

content/uploads/2015/12/2-shot-micro-molding.jpg) 2-Shot Micro molding

Micro molders also have the ability to mold two different materials on the same part simultaneously. Two different thermoplastic resins are shot in sync, requiring only one mold cycle. This method can add valuable cosmetic or functional properties, reduce labor, or make the part more robust.

The image above has a soft durometer material in the center, surrounded by a hard ABS structural material. This part is created in a single mold, eliminating the need to build two parts and assemble them later, saving time and resources.

Micro-Optics Micro Molding

The world of micro-optics and micro-molding seem to go hand in hand. This high-tech market sector requires micron level features and micron level tolerances.



(http://www.accu-mold.com/wp-

content/uploads/2015/12/micro-lens-molding.jpg) Micro Polymer Optics

Although most think of telecom, micro optics parts are also used in products like medical diagnostics, endoscopic, minimally invasive surgical tools, and micro sensor applications. The image to the right is a 12-lens array for the high-bandwidth data market. Made of Sabic's Ultem® (https://www.accu-mold.com/micro-molding-capabilities/material-selection/#peek) material, each lens is 250 μ m in diameter on 250 μ m centers. The noncumulative positional tolerances of each lens from the datum post is $\pm 3\mu$ m.

In-House Tooling & Production



(http://www.accu-mold.com/wp-

content/uploads/2015/12/in-house-tool-room.jpg) In-House Tooling

To achieve precise tolerances at scale requires having full control of tooling and production under the same roof.

Having in-house tool design (https://www.accumold.com/frequently-asked-questions-faq/will-your-tool-roomsell-molds/), build and maintenance resources is a significant advantage when dealing with extremely tight tolerances and complexities of critical components. The end goal; making high quality parts on a consistent basis, requires multiple teams to work closely to achieve a common goal.

Experienced in-house tooling, design engineering, project planning, process engineering and quality engineering resources (https://www.accu-mold.com/frequently-asked-questionsfaq/dfm-engineering-help-micro-molding/) all communicate seamlessly and in-person to ensure accuracy and clarity. This assures a fully developed design for manufacturing. Outsourcing even one these responsibilities with manufacturing projects this complex, would negatively effect quality.

What Is Micro Molding?

In-house tool makers are integral members of the project management team, as are the quality technicians and process engineers. The team must plan and execute many sophisticated production processes while maintaining strict project timelines. The need for clear on-going communications all along the way is essential.

In-house resources also play a critical roll in routine maintenance, running product changes or repairs that may be required. Success is never guaranteed, but probability of a successful outcome increases dramatically when project and production planning, timeline and execution responsibility all lie within the control of a single entity.

Automation & Packaging



(http://www.accu-mold.com/wp-

content/uploads/2015/12/automation-packaging.jpg) In-House Automation Team

Part handling and packaging may seem like a second thought, but it can be just as important as actually making the part. Sometimes, catching the part, can be more difficult than making the part (https://www.accu-mold.com/whats-more-difficult-thanmolding-a-micro-part-handling-it/). Packaging a component so it's oriented in a manner that's useful to the customers automation or assembly process can be just as important as part accuracy.

In-house custom automation (https://www.accu-mold.com/micromolding-capabilities/in-house-processes/) and packaging can come in many forms. This can be reel-to-reel packaging, light subassemblies, lead frame die-forming and singulation, in-line inspection, or a wide variety of other custom secondary processes.

Product handling is also a necessary consideration. Surface contamination can be at a minimum a nuisance for parts this size. Delicate features need proper processes in place to make sure the product arrives to the customer undamaged. Automation and clean room molding may be required.

These added services complete the total micro-molding service and sometimes can be the difference between project success and failure.

Quality Assurance



(http://www.accu-mold.com/wp-

content/uploads/2015/12/close-tolerance-metrology.jpg) In-House Quality Assurance

Quality assurance (https://www.accu-mold.com/micro-moldingcapabilities/quality-service/) is imperative to accurate micromolding. The ability to prove that parts are made to spec, routinely, is where true capabilities are tested.

Quality begins at the start of each project. Design for manufacturability reviews are performed to ensure the project is off on the right foot. Considerations for quality, the robustness of the process and the ability to inspect and measure happen as early in the process as possible.

From there, control plans addressing critical features, FMEA results and other quality requirements are developed. Measurement plans using precision gage pins, high-resolution inline vision systems or white light interferometers may be employed where necessary. Verification of tool dimensions as well as finished part dimensions often requires high magnification microscopic measurements.

Material Selection Process

Finding the best micro molding materials (https://www.accumold.com/frequently-asked-questions-faq/best-micro-moldingmaterials/) isn't cut and dry. While it may sound obvious to simply

What Is Micro Molding?

pick a high-flow resin (https://www.accu-mold.com/high-flowresin/), it might not be the best choice (https://www.accumold.com/high-flow-resin/). In the world of micro-molding, mission-critical components often require exotic or highly engineered compounds. Materials used come in as many forms as project ideas in the mind of a Mechanical Engineer. Like solving a Rubik's cube however, changing just one aspect, can undermine projects goals.

Materials like PEEK (https://www.accu-mold.com/micro-moldingcapabilities/material-selection/#pmma), PEI (Ultem (https://www.sabic.com/en/products/specialties/ultemresins/ultem-resin)®), carbon filled LCP (https://www.accumold.com/micro-molding-capabilities/material-selection/#pei) or glass filled nylons are commonplace. Soft durometer or elastomeric resins are also prominent. Direct experience with these materials in the context of micro-molding is another part of valuable know-how needed to maximize the performance of the resin/part design combination.

Customer Satisfaction



(http://www.accu-mold.com/wp-

content/uploads/2015/12/24-7-production-facility.jpg) Ankeny, IA

When it's all said and done it's about the finished component or assembly. An authentic micro-molder produces extreme parts consistently and efficiently every time. The artistry and ingenuity in the process is lost if, in the end, the product does not satisfy the customer.

Even though micro molding may seem new and novel, Accumold has been in the "micro" business for more than three decades and have produced more than 3 billion micro molded parts to date. It's where we started as a company, and it's where we continue to grow, innovate and produce.

True micro molding is our way of thinking, our way of doing, and our way of life. We've love to tell you more.

What is Micro-Molding? (http://www.accumold.com/micro-moldmicromolding/) Request Quote (http://www.accumold.com/contact/) FAQ (https://www.accumold.com/frequently-askedquestions-faq/)

ISO 13485:2016 (https://www.accumold.com/wpcontent/uploads/2019/11/Accumold-13485-Cert.pdf) ISO 9001:2015 (https://www.accumold.com/wpcontent/uploads/2018/10/Accumold-ISO-9001.pdf) ISO 14001:2015 (https://www.accumold.com/wpcontent/uploads/2018/10/Accumold-ISO-14001.pdf)

Accumold

1711 SE Oralabor Rd Ankeny, IA 50021 Phone: 1-515-964-5741 (tel:+1-515-964-5741) Fax: 1-515-964-5742

Read Accumold's Privacy Policy (https://www.accu-mold.com/privacypolicy)

© 2021 Accumold | Powered by eWay Corp (https://www.ewaycorp.com/).