Amorphous Metal Moulding
Injection moulding for high-tech applications
A strong partnership
for a material with a future

ENGEL and Heraeus are pooling their wealth of expertise in the production and processing of amorphous metals. The German technology group has now released the Amloy product line, an array of alloys that have been specially optimised for injection moulding. And this is where ENGEL enters the scene: the Austrian machine manufacturer has developed a new hydraulic injection moulding machine precisely for this revolutionary material.

A combination with the potential
to change the world

Across all areas of our daily lives, new materials are the basic building-block for our progress into the future. Alongside Amloy, examples of this include a huge variety of plastics – our core business area. Combined with emerging and new manufacturing processes, new materials present even more opportunities. The partnership between ENGEL and Heraeus will lay the foundation for customer success.

Extreme strength and hardness
while offering high ductility

Amorphous metals have a randomly arranged, non-crystalline structure, making them both extremely hard and highly elastic. Thanks to ENGEL’s machines, the material can start to exhibit these special attributes, providing new product qualities for use in the transportation, aerospace, medical technology, manufacturing, lifestyle and electronics sectors.

The Amloy product line:
a step ahead of standard materials

The Amloy line includes zirconium-based alloys and copper-based materials. The products are biocompatible in line with ISO 10993-5 and outperform standard materials such as titanium, stainless steel and hardened stainless steel in terms of hardness, strength, elasticity, corrosion resistance and surface finish. The injection moulding process developed by ENGEL also achieves impressive results compared with other methods:

<table>
<thead>
<tr>
<th>AMM</th>
<th>Die casting</th>
<th>MM</th>
<th>Precision casting</th>
<th>Machining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reasonably priced, highly complex parts</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Smooth surface finish (&lt;2.0 µm) without need for secondary finishing</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>High elastic limit</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Single-stage process</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>High level of hardness without heat treatment</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>High strength without heat treatment</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Tolerances (as % of dimensions)</td>
<td>± 0.075</td>
<td>± 0.4</td>
<td>± 0.3</td>
<td>± 0.5</td>
</tr>
</tbody>
</table>

Design guidelines:

- **Parts weight:** up to 80 g
  (100 g maximum shot weight, 14.9 cm³)
- **Maximum dimensions:**
  100 mm in length
- **Wall thickness:** 0.6 mm to 4.0 mm
- **Dimensional stability:** +/- 0.01 mm
A revolutionary material like Amlay needs a game-changing processing solution. And ENGEL has the ideal machine for the job. After taking a focused look at the product line's technical properties, we have developed a new hydraulic injection moulding machine, whose injection unit in particular sets it apart from a conventional injection moulding machine for plastics processing. For instance, the machine reaches very high injection speeds of 1,000 mm/s, making it possible to achieve very low wall thicknesses, which in turn enables optimum use of Amlay's higher material strengths.

**Injection unit – specially modified for AMMs**
- Injection speed up to 1,000 mm/sec
- Sophisticated melting chamber design
- Fast heat-up period
- Energy-efficient induction heating
- Effective evacuation method

**Injection moulding process – highly integrated automation**
- Robot (viper) removes blanks from the separation unit
- Directly deposited into the melting chamber
- Melting chamber evacuated using integrated vacuum pump
- Melting process via induction heating, followed by injection
- Part moulded
- Removal of the new blank and injected part
- Deposited on the conveyor belt with cooling tunnel

**Option to add material infeed systems**
- Vibrating conveyor belt or two-part chute (manual)

**Fully hydraulic clamping unit with patented tie-bar-less design**
- Large opening stroke
- Flexibility for reduced or increased mould heights
- Optimum clamping force distribution
- Free access for linear robot (viper)
- Hydraulic core-pulls can be moved without ancillary supplementary unit

**Wide range of benefits on various levels**

The ENGEL victory is the ultimate choice for processing Amlay: this game-changing tie-bar-less concept ensures outstanding levels of energy efficiency and precision, along with minimal mould wear. In addition, the machine’s large, unobstructed space between the platens create the perfect conditions for automation, while providing greater flexibility for the mould area. This comprehensive array of useful features, combined with specially designed machine components, make the victory 120 AMM a truly visionary solution for processing amorphous metals.

**Short cycle time and greater energy efficiency**
In a single step of just 60 to 120 seconds, depending on size and geometry, one or more fit-for-purpose components are produced from blanks. These are an exact duplication of the mould’s surface. The material composition and the fully automated production process, from melting to the dynamically controlled injection process, result in a cycle time that is up to 70% shorter than that of previous solutions for injection moulding with amorphous metals. In addition, the required heating capacity is reduced by 40% to 60%, which substantially improves the cost-effectiveness of amorphous metal injection moulding.
A material for many industries

Technical moulding

Ideal for the aerospace and sports industries, amorphous metals make long product life possible under tough external conditions. In addition, ENGEL’s associated injection moulding process for AMMs offers maximum precision within the tightest tolerances and ensures cost-efficiency in production.

Teletronics

Customers using a system based on Amloy and injection moulding technology from ENGEL will find it quick, simple and efficient to make smart components for a wide range of applications, including mobile communication, entertainment and computer electronics, and a huge variety of different displays.

Medical

Minimally-invasive treatment methods require instruments that are durable, but still flexible enough to adapt to the anatomy. Amloy can meet these criteria and many more due to being corrosion resistant and biocompatible as per ISO 10993-5.

Automotive

Amorphous metals are ideally suited for use in decorative and technical parts, leaving a compelling impression thanks to their high-quality aesthetics and haptic features. Their excellent hardness is an additional advantage, as these parts do not scratch or wear, even when subject to intensive use.

ENGEL e-connect.24
Round-the-clock online support from skilled specialists

Service experts from our locations around the world help you resolve unscheduled machine downtimes fast – at any time. Thanks to our cost-saving remote maintenance package, your machine can quickly resume trouble-free production. The result is an optimised support process and even more productivity with a short payback period.

Your e-connect.24 benefits at a glance

- Free 24/7 online support for immediate assistance
- Guaranteed maximum response time of two hours
- World-wide remote maintenance by ENGEL experts
- Quick troubleshooting, keeping downtimes to a minimum
- Maximum machine availability and absolute data security
- Complete service history
- Overview of your machinery status via free e-connect app, regardless of location