

## Magnesium on the Brink or Beginning of a New Era?

Christoph Schendera<sup>1\*</sup>, Gerhard Geishüttner<sup>2</sup>, Andreas Kraly<sup>3</sup>

1. European Research Association for Magnesium, Aalen, Germany

2. GG-Giesstechnik GmbH & Co. KG, Nümbrecht, Germany

3. High Performance Industrietechnik GmbH, Braunau-Ranshofen, Austria

\*Corresponding address: e-mail: c.schendera@efm-aalen.de

**Abstract:** lightweight metal Magnesium, European CO2 targets, unique processes, Atomizing & Horizontal Continuous Casting of liquid Magnesium

### Introduction

Magnesium is a unique lightweight metal in terms of specific mechanical properties and also based on its unlimited eco-friendly raw material sources. However, Magnesium faces enormous challenges in Europe due to (1) self-limiting European CO2 targets, resulting in European regulations, like e.g. „Fit-for-55“ or CBAM, (2) the one-sided dependence on China coupled with unpredictable price-jumps and (3) pressure from the Aluminum industry.

As part of the European Climate Law „Fit-for-55“, the EU has committed to reducing its net CO2 emissions by at least 55% by 2030. This results that with the new CO2 standards, all new passenger cars and light commercial vehicles registered in Europe should be emission-free by 2035.

The increased focus on E-mobility and the associated reorientation of R&D have stalled the development of new magnesium components (like e.g. automatic transmissions) at some European OEMs.

Even worse is the fact that the strict CO2 targets mean that proven and long-established Magnesium components are at risk of being replaced by recycled European Aluminum with lower CO2 emissions.

The European Magnesium Association for Magnesium, a strong supporter of Magnesium, welcomes the growing interest and developments in Magnesium in China and is for their part also working with its members on continuous improvement of the furnace and melting technology as well as unique processes for a better, safer and more environmentally friendly future for Magnesium.

In the following 2 unique processes from liquid Magnesium to semi-finished products are described in more detail:

### (1) Horizontal Continuous Casting Line for the production of Magnesium billets

High Performance Industrietechnik GmbH [1] has developed a new continuous Horizontal Casting Line (HPI ForgeMaster Line), which brings the process of horizontal casting of forging stock for Aluminum into a new millennium.

The new ForgeMaster Line has recently been installed at Hydro Rackwitz, Germany and enables the production of forging stock in diameters from 42 mm to 110 mm with high surface quality.

Once the starting conditions are met, the furnace is tilted to the desired height in the casting trough and the dams for filling are automatically opened and closed while the system checks that proper temperatures have been reached.

The ForgeMaster system optimizes solidification conditions and ensures a more uniform distribution of material properties (due to improved microstructural isotropy), resulting in a minimal edge zone and limiting losses due to peeling. The casting line is capable of producing forging stock in diameters from 42 mm to 110 mm with high surface quality.

Besides its Hot Top Vertical Continuous Casting (Magnumcast®), HPI also developed the first Horizontal Casting Line for the production of Magnesium billets or ingots for further processing to profiles, sheet and forgings or as well as high quality Mg-alloy ingots for its use in the Magnesium die casting industry and A game changer for the Magnesium industry!



Fig. 1. HPI ForgeMaster Line

### (2) Atomizing of liquid Magnesium for the Production of Powder and globular Granules

GG-Giesstechnik GmbH & Co. KG (GGG) develops and produces the world's largest and most modern & efficient casting lines, with melting capacities between 80- 1.500 kg/h. [3]

Fig.2 shows one of the largest casting lines in Europe with a melting capacity of 1.400 kg/h, based on

customized multi-chamber melting & dosing furnaces as well as cover gas mixing units for N<sub>2</sub>/Dry Air/SO<sub>2</sub>/CO<sub>2</sub>.

Two robots stack the incoming ingots into 4 pre-heating units, which are directly connected to 4 melting furnaces. The molten Magnesium is transferred into 8 dosing furnaces to simultaneously feed 8 fully automated die casting cells. The solidified components are removed by a robot. The gating system is automatically separated and fed back into the melting furnace.



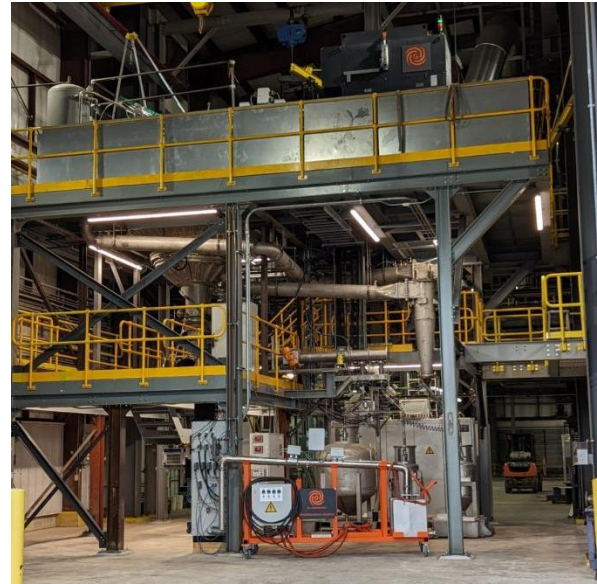
**Fig.2. GGG Casting Line with a Melting Capacity of 1.400 kg Mg/h**

GGG's and his partners also developed novel industrial equipment, such as a novel Atomizer for the direct production of Powder and globular Granules from liquid Magnesium (Fig.3).

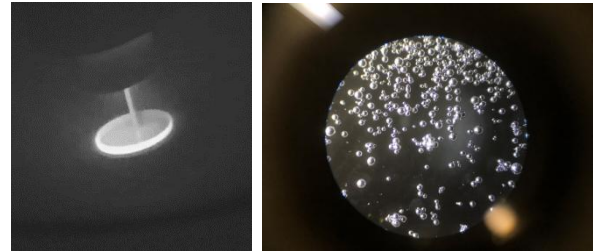
The novel Atomizer offers a high degree of flexibility on various Magnesium alloys with different particle size distributions for the use in the Chemical, Steel/Titanium, additive manufacturing as well as for the Mg-Thixomolding industry.

The melting furnace sits on the Atomizer unit, from which the liquid Magnesium is fed into the atomizer chamber flooded with protective gas. Here the liquid Magnesium hits the rotating disk under high pressure (Fig.4).

The actual particle size varies between 0,2 – 1,0mm, as shown in Fig.5. In a further process step, the solid particles are fed into a cyclone, where they are separated into the different particle classes for their respected use.



**Fig.3. Novel Mg Atomizer developed by GGG**



**Fig.4. Rotating Disc Fig.5. Particles 0,2-1,0mm**

**References**

- [1] <https://www.hpi.at>
- [2] <https://www.lightmetalage.com/news/industry-news/forging/hydro-starts-producing-high-quality-automotive-forging-stock-in-germany/>
- [3] <https://giesstechnik.de>