

The European Lightmetal Sector - current Status & Activities

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Abstract: The European light metals industry stands at a crossroads, facing structural challenges from geopolitical tensions, ambitious climate targets & regulatory burdens, high energy costs & global competition. This presentation highlights the legal framework, strategic challenges and the current activities and developments facing the European lightweight sector in general and the Magnesium sector in particular. In order to meet the strict European regulations, there is a growing trend towards lightweight components in vehicle design with a growing demand for advanced lightmetals and alloys.

Keywords: Lightweight Metal Magnesium, European CO₂ targets, unique processes, Atomizing & Horizontal Continuous Casting of liquid Magnesium

1 Introduction

The European lightmetals industry stands at a crossroads, facing structural challenges from (1) geopolitical tensions, (2) ambitious climate targets & regulatory burdens, (3) high energy costs & global competition.

The convergence of the above challenges is leading to rapid transformations of the global industry, with the automotive sector, an important pillar of the lightmetals industry in Europe, being particularly affected. Car manufacturers such as BMW, Mercedes-Benz, Volkswagen and Stellantis have cut back their production and even announced possible plant closures for the foreseeable future.

This presentation highlights the legal framework, strategic challenges and the current activities and developments facing the European lightweight sector in general and the Magnesium sector in particular.

1.1 Geopolitical tensions and trade barriers

Geopolitical tensions, particularly the Russia-Ukraine war as well as conflicts in the Middle East, have directly disrupted global supply chains for raw materials, resulting in significantly increased (shipping) costs and delivery times for critical materials. For example, the reduction in Russian gas supplies has forced Europe to rely on expensive LNG imports, exacerbating cost pressures.

Furthermore, American import duties on European goods are exerting additional pressure on demand for European vehicles and thus on the continued use of Magnesium. As a result, overall demand for metals has fallen sharply and Magnesium has been hit particularly

hard. ^[1]

1.2 Ambitious climate targets & regulatory burdens

The European Union (EU) has committed to reducing its net CO₂ emissions by at least 55% by 2030 vs. 1990 and to achieve carbon neutrality by 2050.

Key regulatory instrument is the European Climate Law “Fit-for-55” with the following essential directives and regulations: ^[2, 3]

- Replacement of the EU Emissions Trading System by the Carbon Border Adjustment Mechanism (CBAM)
- Renewable Energy Directive (RED)
- Energy Efficiency Directive
- Alternative Fuels Infrastructure Directive (AFID)
- Regulation setting emission standards for new passenger cars and new light commercial vehicles
- Regulation “ReFuelEU Aviation”
- Regulation “ReFuelEU Maritime”

CBAM, which came into force in October 2023, creates a clear pathway for low and zero carbon products. From January 2025, manufacturers of metals, covered by CBAM, will be required to submit verified carbon footprint declarations. Although Magnesium and its alloys are not currently directly included, Magnesium is an important alloying element for many Aluminum applications. To maintain its role in die casting and other sectors, the carbon footprint of Magnesium must therefore be significantly reduced.

1.3 High Energy Costs & global Competition

As a result of the reduction in Russian gas supplies, Europe experienced the highest energy prices worldwide.

In Germany, there was an average increase between 65-86 EUR/MWh in 2019 and 162-186 EUR/MWh in 2023. In the USA, the gas price crisis briefly led to a more than doubling of end customer electricity prices in 2022 (84-102 EUR/MWh) and approached the pre-crisis level between 42-51 EUR/MWh in prices in 2023. In China, electricity prices remained stable. Average prices rose by +3% in 2019 (79-97 EUR/MWh) to 2023 (81-101 EUR/MWh - mainly due to exchange rate changes).^[4]

The burden of high energy prices, limited access to renewables, and high CO₂-related costs have already triggered a process of deindustrialization, with production shifting outside Europe and a worsening trade balance for energy-intensive industries.^[5, 6]

The European Union (EU) has set strict decarbonization targets for the automotive and metals sectors, requiring a shift away from fossil fuel-based production processes and increased use of recycled materials

The EU has launched initiatives such as Clean Industrial Deal, which includes tax incentives, subsidies for energy-intensive industries, and investments in renewable energy to help offset high production costs.^[7, 8]

Shift to Lightweighting and Green Materials:

In order to meet the strict European regulations, there is a growing trend towards lightweight components in vehicle design with a growing demand for advanced lightmetals and alloys.

At the same time, the sector is under pressure to adopt low-carbon materials, such as green Steel and recycled Aluminium, to meet ambitious climate targets.

While Magnesium offers a clear advantage in lightweight applications, its production has a higher carbon footprint than (recycled) Aluminum, contributing to a trend of substitution toward Aluminum in the European market.

The EU's Critical Raw Materials Act prioritizes the domestic production of strategic metals, but Magnesium lacks the same focus as Lithium or Aluminum.

Aluminum benefits from an established recycling network and policy support. Without a rapid decarbonization of Magnesium, substitution toward Aluminum will likely accelerate, particularly in sectors prioritizing Scope 3 emission cuts.

Low-carbon Magnesium targeting <1 ton CO₂ per ton Mg could revive its competitiveness.

Magnesium's future in Europe hinges on break-throughs in a cleaner production of European Primary Magnesium

and unique processes from liquid Magnesium to semi-finished products.

Primary Magnesium Production in Europe:

There is currently no industrial production of Primary Magnesium in Europe nor in Germany. All European activities focus on recycling of Mg scrap.

Europe aims to revive Magnesium output to cut China reliance. In the last 2-3 years, the following projects have been initiated:^[9, 10]

- Verde Mg / Romania with a theoretical Capacity of 20.000 MT/year (based on Aluminotherm)
- Magnesium for Europe / Bosnia-Herzegovina with a theoretical Capacity of 50.000 MT/year (also based on Aluminotherm)
- Mures Mg / Romania with a theoretical of 20.000 MT/year (based on Electrolysis).^[11]

All 3 projects are still at an early stage and are not expected to be completed before 2026-2027.

The European Magnesium Association for Magnesium (EFM e.V.), a strong supporter of Magnesium, welcomes the growing interest and developments in China. Together with its members the EFM e.V. works on the continuous improvement of furnace & melting technology as well as unique processes for a better, safer and more environmentally friendly future for Mg.

Unique Processes from liquid Mg:

Most sophisticated Melting & Covergas Unit @ GGG & ASKI Gasetechnik

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 (Fig.1).

In combination with the special inert gas supply from ASKI Gasetechnik the oxide formation on the bath surface and usage of covergas can be reduced to a minimum. Compared to ordinary systems, like e.g. Rauch, the ASKI inert gas unit offers a modular design for the use of to all types of covergases, including N₂, Dry Air, SO₂, CO₂ and even CNHM-612. The ASKI inert gas supply saves large quantities of harmful emissions that would otherwise be released.^[12]



Fig. 1. Casting Line with a Melting Capacity of 1.400 kg Mg/h & ASKI inert gas supply

Atomizer @ GG Giesstechnik

The novel Magnesium-Atomizer is the first of its kind in the world and offers a high degree of flexibility in the production of various particle size distributions for the use in the Chemical, Steel/Titanium as well as for the Magnesium-Thixo-molding industry.

The melting furnace sits on top of 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.

The globular granules vary between 0,2 – 1,0mm. In a subsequent process step, the solid particles are fed into a cyclone, where they are separated into the different particle classes for their respected use. Due to the permanent inert gas atmosphere in the atomizer, the production of magnesium powders is at a different safety level when compared with the ordinary and risky “mechanical planing of ingots”(Fig.2).^[13]



Fig. 2. Novel Atomizer developed @ GGG for the production of globular particles 0.2 - 1.0 mm

Horizontal Continuous Casting Line for the production of Mg-billets @ HPI

High Performance Industrietechnik GmbH (HPI) 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

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 micro-structural isotropy), resulting in a minimal edge zone and limiting losses due to peeling.

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 - A game changer for the Magnesium industry !!!^[14, 15]



Fig. 3. HPI ForgeMaster Line for the production of Magnesium billets or ingots

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