

**Magnesium Industry:  
classification and industry chain,  
from traditional smelting to high-end manufacturing change**

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Magnesium, as the most potential lightweight metal material in the 21st century, its industrial classification, industry chain composition and transformation and upgrading under the technological revolution can be analyzed in depth from the following dimensions.

## **I. Magnesium Industry Classification**

According to the process and production characteristics, magnesium industry can be divided into: "**original magnesium smelting, alloy casting, alloy processing, waste magnesium recycling**" four categories.

### **1. Original magnesium smelting**

The original magnesium smelting is the magnesium ore in the magnesium element through physical and chemical methods to separate out, get high purity magnesium process. The main processes include:

**(1) silicon thermal method (Pijiang method):** the use of ferrosilicon as a reducing agent to reduce magnesium oxide, is the mainstream magnesium smelting methods

**(2) Electrolysis:** obtain magnesium metal by electrolyzing molten magnesium chloride

Refined magnesium metal is commonly known as "crude magnesium", usually need to carry out primary processing and purification, the production of various specifications of magnesium ingots, magnesium rods, magnesium powder and other "fine magnesium" products, magnesium alloys are the basic raw materials.

## 2. Alloy melting and casting

Magnesium alloy is an alloy material formed by adding other elements (such as aluminum, zinc, manganese, etc.) with magnesium as the basic element, and the product form includes "ingot, plate, rod, belt, wire, grain", etc. The magnesium alloy has the advantages of low density, low specific gravity, **high density and high specific gravity**. Magnesium alloys are characterized by low density, high specific strength and stiffness, good vibration damping, and excellent electromagnetic shielding properties.

## 3. Alloy processing

Downstream processing enterprises will magnesium alloy materials through die-casting, extrusion, forging and other processing processes, made of parts and products in various fields, including automotive parts, electric bicycles, aerospace, rail transportation, 3C electronic products, robotics, low-altitude aircraft, hydrogen storage materials and other applications.

## 4. Waste magnesium recycling

Based on the easy recycling characteristics of magnesium and magnesium alloy materials, waste magnesium recycling has become an important part of the magnesium industry. Magnesium and its alloys can be 100% recycled, and recycling energy consumption is only 5% of the original magnesium production, with significant economic and environmental benefits.



## **Second, the composition of the magnesium industry chain**

Magnesium industry chain is a complex system with multiple links and fields of synergy, including the following links:

### **1. Upstream: resource side**

1) Magnesium mining: magnesium-containing solid minerals mainly come from dolomite, magnesite, hydromagnesite and olivine, etc.

(2) Ferrosilicon production: provide reductant for Pijiang method

3 Energy supply: raw coal, semi-coke oven or generator gas, semi-coke gas for self-power generation, etc.

### **2. Midstream: smelting and processing**

(1) Primary magnesium smelting: produce primary magnesium by Pijiang method or electrolysis method. China owns more than 90% of the global magnesium production, mainly concentrated in Shaanxi, Shanxi, Inner Mongolia, Xinjiang, Anhui and other regions. Fugu County in Shaanxi Province alone accounts for 55% of the country and more than 45% of the world's share, known as "China's magnesium valley - the world's magnesium capital".

(2) Alloy casting: production of various specifications of magnesium alloy materials. Mainly located in Anhui and Shanxi.

(3) Alloy processing: through a variety of processes to make end products. In addition to Shanxi and Anhui, magnesium alloy processing enterprises are mainly located in the Yangtze River Delta and Pearl River Delta.

4 Comprehensive utilization: comprehensive utilization of solid waste generated in the production process, waste heat utilization, etc.

### **3. Downstream: application fields**

#### 1) Traditional application fields

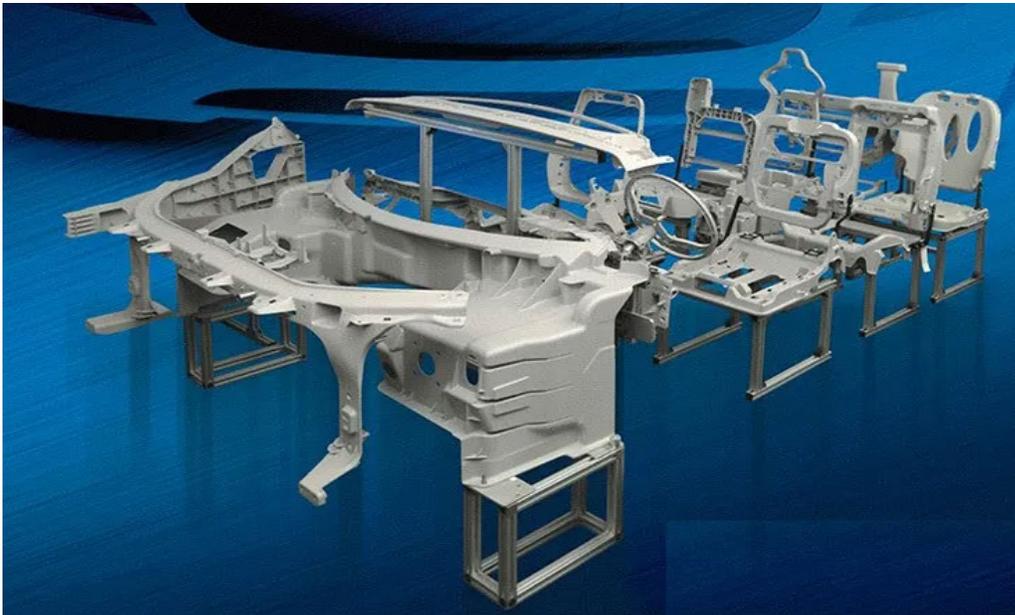
① Iron and steel desulfurization: as a desulfurizer for iron and steel smelting

② metal reduction: as a titanium and other metal reducing agent

③ Aluminum alloy addition: to improve the strength and processing performance of aluminum alloy.

#### 2) Emerging applications

- ① New energy vehicles: battery pack shell, motor shell, steering wheel skeleton and other lightweight components
- ② electric bicycle: frame, hub, handle and other parts of the weight reduction
- ③ Aerospace: fuselage frame, wings, hatches and other key components for weight reduction
- ④ rail transportation: high-speed rail seats, luggage racks, etc.
- ⑤ 3C electronic products: laptop shell, cell phone frame, camera body, etc.
- ⑥ Robotics: structural parts, joint parts, etc.
- ⑦ Low-altitude economy: eVTOL aircraft structural components
- (8) hydrogen storage materials: magnesium-based solid-state hydrogen storage materials
- ⑨ medical devices: wheelchairs, prosthetics and other medical equipment



typical magnesium-optimized automobile construction

## China's magnesium industry status and challenges

### 1. Industrial advantage

In the global magnesium industry occupies a dominant position:

- 1) Accounting for 70% of the global magnesium resource reserves

- 2) Accounting for more than 90% of the global magnesium output
- 3) Form a complete industrial chain system
- 4) Obvious cost advantage

## **2. Challenges**

1. **Environmental protection pressure:** under the goal of "double carbon", "energy saving, carbon reduction, emission reduction, intelligence and so on are facing the pressure of upgrading and transformation.
2. **Technical bottleneck:** high-end magnesium alloy materials and deep processing technology is still a gap.
3. **International competition:** facing competition from other lightweight alternative materials such as carbon fiber.
4. **Trade barriers:** anti-dumping measures in Europe and the United States and other countries and carbon border adjustment mechanism.

## **Development trend and outlook**

### **1. Direction of technological upgrading**

- (1) **Green smelting technology:** research and development of green smelting process with low carbon emission, low energy consumption and low emission.
- (2) **Deep processing technology:** improve the precision and performance of magnesium alloy products.
- (3) **Semi-solid molding technology:** improve production efficiency and product quality.
- (4) **Intelligent manufacturing:** "government, industry, academia, research and application" collaborate to promote automation and intelligent production.

### **2. Market Prospect**

With the strengthening of lightweight trend and the expansion of emerging applications, magnesium industry is ushering in the "second growth curve":

- (1) The amount of magnesium used in new energy vehicles is expected to increase from about 12kg to more than 45 kg in 2030.

(2) The introduction of new regulations for electric bicycles to speed up the process of "magnesium instead of plastic".

(3) Robotics, low-altitude economy and other emerging fields bring new demand.

(4) Magnesium-based solid hydrogen storage and other cutting-edge applications may bring revolutionary breakthroughs.

### 3. Industrial transformation path

(1) High-end: from primary products to high-end magnesium alloy materials and products.

(2) Greening: developing circular economy, reducing energy consumption and emission.

(3) Intensification: improve industrial concentration and cultivate leading enterprises.

### 4. Internationalization

Enhance international competitiveness and cope with global market changes.



As a strategic new material, magnesium is transforming from a traditional metallurgical additive to a high-end manufacturing material. Although China occupies a dominant position in the global magnesium industry, it still faces the urgent task of transformation and upgrading. In the future, through technological innovation, industrial upgrading and application expansion, magnesium industry is expected to rely on the trend of lightweight, from the incremental application to promote the expansion of the industry's scale at the same time to realize the transformation to value enhancement, and

make an important contribution to the global low-carbon transformation and manufacturing upgrading.

In the "double carbon" goal and a new round of scientific and technological revolution under the dual drive, magnesium industry is experiencing profound changes. Grasping the development trend of magnesium industry, forward-looking layout of key technologies and high value-added areas will be the key to seize the opportunity of this wave of material revolution.

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