Development Status, Trend and Prospect of Magnesium Alloy Materials

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Abstract:

Based on the current situation of magnesium alloy industry in China, the main problems at home and abroad are analyzed. The future market demand prospect of Chinese magnesium alloy material industry in 11 aspects, such as high performance rare earth magnesium lightweight structural alloy material, high strength and high thermal conductivity magnesium alloy materials, high intensity and high conductivity magnesium alloys materials and super high strength magnesium alloys. A phased development plan for 2030 and 2035, This paper puts forward some strategies to promote the sustainable development of advanced magnesium alloy industry in China from the aspects of improving independent innovation ability, optimizing resource allocation, strengthening enterprise cooperation, constructing perfect magnesium alloy research system and perfecting platform construction. Finally, it puts forward countermeasures and suggestions from the aspects of paying attention to the construction of research system, optimizing the industrial development pattern, constructing high-quality and efficient industries, perfecting the supporting policy system and constructing the elite talent system. In order to meet the needs of national economy, national major projects and social sustainable development of advanced magnesium alloy materials.

Keywords:
Metal materials industry; Magnesium alloy; Rare earth magnesium alloy material; Low energy consumption; High efficiency; 2035

I. Preface

The rapid development of basic materials has brought great changes to the social, economic and cultural systems of the world. As an important category of advanced basic materials industry, China's magnesium alloy material industry has responded to the implementation of the "13th Five-Year Plan" series of strategic measures, We have developed more than 10 kinds of magnesium alloy materials and successfully applied them in the fields of aviation, aerospace, defense industry, automobile and so on, which greatly reduces the cost of magnesium alloys and improves the market competitiveness. China is rich in magnesium resources, stimulated by the demand of automobile energy-saving emission reduction and lightweight, it is expected to promote the further development of magnesium alloy consumption market, and bring opportunities and challenges for industrial Following the global trend of green energy conservation, China's magnesium alloy industry is developing towards low energy consumption, high efficiency and high quality, and constantly upgrading the industry. The research of magnesium alloy technology in China started later than the developed countries in Europe and the United States. Although a number of key technologies have been broken through in some magnesium alloy fields, there are still big gaps in research and development efficiency, production quality, market expansion and environmental protection. In the future, China's magnesium alloy industry should take the national strategic demand as the benchmark, keep up with the international research hot spots, strengthen the research and development of advanced magnesium alloy materials and strive to improve the independent innovation ability while continuously improving the overall level of the industry. Through optimization of the organization and implementation mode, help the national major projects urgently needed advanced magnesium alloy materials "production, study and research" system channel smooth, To promote the transformation of relevant scientific research achievements and realize the industrialization application, realize the strategic transformation from material power to material power in China, meet the national economy, national major projects and social sustainable development of advanced magnesium alloy materials demand.

Development status and problems of advanced magnesium alloy industry in China

(1) Current Development

1. The upgrading trend of magnesium alloy material industry is obvious

Since the 13th Five-Year Plan, China's magnesium alloy industry has implemented independent innovation strategy, Through the combination of "production, study, research and use," relying closely on scientific and technological progress and technological innovation to improve the material quality uniformity, effectively improve the effective supply capacity and level of high-end materials industry. Under the new normal, China will gradually change its traditional mode

of high input, high consumption, high pollution and high emissions. In the transition to a development model of low input, low consumption, high output and low pollution, new processes and methods with short flow, low cost and low energy consumption are emerging.

2. Production capacity and market consumption of raw magnesium

In recent years, the magnesium industry in China has been running steadily, and the output and export have been increasing continuously. At present, the global raw magnesium production mainly comes from China. According to the statistics of China Nonferrous Metal Industry Society, in 2019, China's raw magnesium output is 9.69 √ó 105 t, up 12.2% year on year; On the price side, affected by the increase of supply, the average price of raw magnesium was 15949 yuan / t, down 3.3% year on year, and the actual profit level of magnesium smelting enterprises decreased slightly year on day; In terms of resource consumption and market, China's consumption of magnesium resources is 4.85 √ó 105 t, an increase of 8.6% year on year, the growth rate increased by 1.6 percentage points, but foreign demand for magnesium resources picked up, In 2019, China exported all kinds of magnesium products about 4.52 √ó 105 tons, up 10.2% year on year, accounting for 46.6% of China's magnesium output.

3. Progress in R & D of Magnesium Alloy Material Industry

In recent years, in view of the weak mechanical properties of magnesium alloy materials in the world, China has actively carried out the research and development of advanced magnesium alloys. Important breakthroughs have been made in engineering technology of rare earth magnesium alloys, large size cast rods and large complex parts. The developed parts of high-strength magnesium alloy large-size complex castings and high-strength heat-resistant magnesium alloy large size extruded profiles / forgings reach the world advanced level. Specifically, in 2019, Nanjing Yunhai Special Metals Co., Ltd. has made significant progress in technology research and development and production integration. The forged magnesium alloy wheels produced are applied in automobile mainframe enterprises. The National Engineering Research Center for Precision Forming of Light Alloys, Shanghai Jiaotong University has developed a new type of high performance light magnesium rare earth alloy material, It has been successfully applied to the key and complex load bearing parts of the helicopter. The lightweight effect is remarkable. And it has achieved batch stable manufacture. It fills the blank of high strength and heat resistant magnesium alloy for the new generation of helicopters in China. The National Magnesium Alloy Material Engineering and Technology Research Center of Chongqing University has developed more than 40 kinds of new magnesium alloys, including AT, AE and VW series. Among them, 16 kinds have become national standard

grades, and more than 10 kinds have been applied and popularized in engineering. Northeast University has developed the production technology of large size magnesium alloy flat ingots, which can produce the largest section of 1450mm √ó 400mm. A complete set of strip rolling technology for magnesium alloy wideband plate has been developed, which has been applied industrially. Units such as Central South University and Changchun Institute of Applied Chemistry have developed batch production technologies for high strength and high toughness rare earth magnesium alloys, high performance die-casting magnesium alloys and rare earth-magnesium alloys. It has been successfully used in aviation, aerospace, defense industry, automobile and electronic products, and has greatly reduced the cost of rare earth magnesium alloy products, improved the market competitiveness and filled the blank in related fields in China.

2) Major problems

1. Industrial development starts late, the foundation is thin, the import dependence of key equipment is high, and the phenomenon of being controlled by people is prominent

China's high performance magnesium alloy industry started late, the foundation is thin, in the overall application is still in the industrial chain and value chain of the low end. At the same time, the implementation rate of related strategic policies is low, the key technology and foreign gap is large, high-end equipment mostly rely on imports. The technology and equipment needed for R & D are often limited by foreign export, which makes the research and development of magnesium alloy materials face difficulties, especially many high-end core materials are difficult to develop, performance improvement is slow, production capacity is also seriously inadequate. In addition, the intelligence level of related enterprises in R & D, production and service is low, and the supporting systems of standards, testing, evaluation, measurement and management are missing. Product performance stability and quality consistency need to be further improved.

2. The scientific research system is not yet complete, the investment in R & D is insufficient, and the building of the talented personnel needs to be improved

At present, there is a lack of sound scientific research system, enterprise-led R & D mechanism still needs to be further improved, "production, learning, research and use" cooperation is not close, there are still barriers. R & D investment in relevant research institutions is low, talent team construction is not perfect, the lack of incentive policy and R and D platform, scientific and technological personnel lack of innovation power. In addition, the risk protection policy for

new technology investment is lacking, so it is difficult for the new technology of research institutes to be popularized and applied in enterprises.

3. Deep-level contradictions and problems in the magnesium alloy material industry such as structural overcapacity and market imbalance between supply and demand have gradually emerged

Under the influence of the international and domestic economic situation, especially the global new coronavirus pneumonia epidemic, the market demand for metal materials is depressed, the long-term accumulation of structural overcapacity in magnesium alloy material industry, the imbalance of market supply and demand and other deep-seated contradictions and problems gradually emerge. At present, China's magnesium industry is running smoothly, output and export volume continue to increase, but there are shortcomings in smelting environmental protection level, deep processing products application and other aspects, industrial transformation and upgrading tasks are still arduous. In addition, the production capacity of magnesium alloy material industry in China is huge, which has a far-reaching impact on resources and environment. There is still a long way to go in the development and application of energy-saving, material-saving and environment-friendly short-flow manufacturing technology.

Analysis of market demand prospect of advanced magnesium alloy industry in China

(1) High performance rare earth magnesium light structural alloy materials
Compared with ordinary magnesium alloy materials, high performance rare earth magnesium lightweight structural alloy materials with rare earth elements have high strength, good toughness, heat resistance and corrosion resistance. It solves the key problem which restricts the wide application of magnesium alloy material, and is the key basic material to promote the development of lightweight in aviation, aerospace, automobile and rail transit. China is rich in magnesium and rare earth resources, mature alloy forming and processing technology, large market application space, rare earth magnesium alloy lightweight structural materials industry system is complete, can be self-produced and sold.

The future market demand of high performance rare earth magnesium lightweight structural alloy materials is mainly focused on: (1) the development and application of low cost preparation technology for high performance magnesium rare earth master alloy and rare earth-magnesium alloy; Development of new high performance rare earth magnesium alloy materials

for application; Development of advanced processing and molding technology and supporting equipment; Perfect the green smelting separation technology of rare earth and accelerate its popularization and application; The system research of material life cycle is oriented, and the collaborative development platform of "production, learning, research and application" is established. Speed up the application of high performance rare earth magnesium lightweight structural materials, in the next 3 to 5 years to realize the transformation of military field to civil field, gradually expand the market scale, will replace the proportion of ordinary magnesium alloy materials to reach 30% by 2035.

(2) Magnesium alloy materials with high strength and high thermal conductivity
With the development of aviation, aerospace, new generation weapons, high-speed trains and new energy vehicles, the number and distribution density of high power density electromagnetic devices are increasing, and the heat generated during operation must be derived immediately. Otherwise, high temperature will seriously affect the stability and reliability of equipment operation, greatly shorten the service life of all kinds of equipment, so how to quickly and effectively derive the heat generation of devices under the background of lightweight is an important problem to be solved.

High strength and high heat conductivity magnesium alloy materials and their products are advanced basic materials and key technologies to support the development of heat-dissipating components such as aircraft, high-speed trains, automobiles and computers. It plays an important role in lightening the equipment and improving the stability and service life of the system. By 2035, it will replace more than 30% of the common high thermal conductivity alloy materials. Traditional metals with high thermal conductivity, such as Ag and Cu, are difficult to meet the practical requirements because of their high density (about 10.5 g / cm3, 8.9 g / cm 3, respectively) and high price. Magnesium alloy materials have the advantage of low density and are one of the potential material systems to meet the application requirements. However, the thermal conductivity of commonly used magnesium alloys is still significantly different from that of aluminum alloys. Therefore, The preparation and processing technology of high strength and high thermal conductivity magnesium alloys with thermal conductivity > 125 W / (m ¬∑ K) and their products is the main development direction in this field.

(3) High strength and high conductivity magnesium alloy materials

Mobile phone, Global Positioning System (GPS) / Beidou satellite navigation system and broadband network system will be affected by the noise caused by high-frequency

electromagnetic wave interference, ordinary notebook computer is vulnerable to electromagnetic signal leakage and lead to information or data leakage. In addition, if the human body long-term exposure to strong electromagnetic field or brain long-term close contact with electromagnetic sources, it may easily induce cancer lesions. Therefore, electromagnetic shielding can not only prevent the electromagnetic wave emitted by electronic equipment to other equipment and human impact, but also protect the electronic equipment from other equipment interference. Excellent electromagnetic shielding effect is a necessary and imperative choice for the development of information home appliances. The effect of electromagnetic shielding mainly depends on the conductive performance of electromagnetic instrument and equipment shell material. The better conductive performance, the better electromagnetic shielding effect.

The traditional high conductive metals such as Ag and Cu are difficult to meet the application requirements in the field of information appliances because of their high density and high price. Therefore, the heat dissipation materials with lower density than aluminum alloy and higher conductivity than common aluminum alloy are urgently needed. Magnesium alloy material has the advantage of low density and is one of the potential material systems to meet the above needs. However, compared with aluminum alloy, the electrical conductivity of magnesium alloy materials is still significantly different. Therefore, the preparation and processing technology of high strength and high conductivity magnesium alloy with conductivity > 17 MS / m and its products is the main development direction in this field. It plays an important role in reducing the weight of products, improving the safety of system operation and ensuring the health of related personnel. It is estimated that by 2035, the amount of magnesium alloy with high strength and high electrical conductivity will be more than 25%.

(4) Super high strength magnesium alloy materials

Ultra-high strength magnesium alloy materials are advanced basic materials to support the development of high-end equipment such as aviation, aerospace, new generation weapons, high-speed trains and new energy vehicles. China is in the forefront of the world in research and development and application of super high strength deformed magnesium alloys. However, from the point of view of further expanding the application of magnesium alloys, the existing high strength magnesium alloys have obvious deficiencies in specific strength, specific stiffness, fracture toughness and consistency of properties. The application of magnesium alloy in the above fields and the improvement of the competitiveness of its end products are seriously restricted, which is an urgent development problem to be solved. Ultra-high strength magnesium alloy material and its strengthening and toughening deformation processing

technology are the main development direction in the field of magnesium alloy. It is estimated that by 2035, the amount of ultra-high strength Mg alloy material to replace the common materials will exceed 20%.

(5) Mg-Al, Mg-Zn and ZK alloy materials

At present, there are many kinds of magnesium alloys, which have been widely used in many fields. In particular, AZ91 magnesium alloy shows stable process, low burning loss, excellent mechanical properties and high strength corrosion resistance at room temperature. Mg-Zn alloys are widely used in wrought magnesium alloys, which exhibit excellent aging strengthening behavior during heat treatment. In this series, ZM81 alloy shows better mechanical properties than Mg-Al alloy. The ZK alloy is mainly Mg-Zn-Zr magnesium alloy, which is one of the most widely used deformed magnesium alloys at present, and is represented by ZK61 magnesium alloy. After high temperature forming cooling and artificial aging treatment, the tensile strength is more than 300 MPa. It has good plasticity and corrosion resistance, good machinability, and can manufacture large forgings with complex shape.

(6) Light rare earth Mg-RE magnesium alloy materials
China's rare earth resources reserves rank first in the world, and it has advantages in rare earth mining and smelting separation. However, the application of 16 rare earth elements (except Pm) is unbalanced, there are some problems such as idle light rare earth, unmarketable, resulting in a large number of domestic rare earths mainly La, Ce and other elements formed a backlog. At present, with the continuous expansion of automotive lightweight, electronic communications and other related industries, The major terminal enterprises and material manufacturers have been committed to the research and development of lightweight components, magnesium alloy material performance requirements to an unprecedented height, even a lot of structural and functional integration needs. This brings a new opportunity for the development of rare earth magnesium alloys, especially the development and application of light rare earths magnesium alloys. The advantages of La and Ce in magnesium alloys are brought into full play, and the application prospect is very wide.

Compared with Mg-Al, Mg-Zn alloys, Mg-RE alloy after alloying with rare earth elements has more stable technological properties and better mechanical behavior in mechanical experiments. Application of La and Ce in Magnesium Alloys AE series magnesium alloys, which are mainly added in the form of mixed rare earths, Typical magnesium alloys, such as AE44 and AE41, have excellent mechanical properties, especially in elongation far beyond AZ91 and AM60.

Mg-RE alloy is easy to be die-cast because of its good fluidity. Its price advantage is obvious. It can meet the large-scale production of civil products, such as automobile gearbox shell and other parts. In addition, the solid solubility of light rare earth in Mg is very low, which is conducive to improving the thermal conductivity of magnesium alloys. In the future, it has great potential in the structure of electronic products, base stations and access network equipment related to the fifth generation mobile communication technology. The application development of high performance light rare earth magnesium alloy material for civil market is helpful to promote the balanced application of rare earth elements, To solve the backlog of high abundance rare earth elements such as La and Ce, expand the application of rare earth in new fields, speed up the transformation and upgrading of the rare earth industry, and highlight the strategic value and supporting role of rare earth resources in China's high-tech industry.

(7) New superplastic magnesium alloy materials

The new superplastic magnesium alloy material is relatively low in production cost, high in profit, and has obvious competitive advantages in the production and application of magnesium alloy. It has been shown that the properties of the new superplastic magnesium alloy developed in China are better than those produced in Japan and have high room temperature strength (tensile strength > 350 MPa, yield strength > 250 MPa). The superplastic deformation ability in the process of stamping is strong (elongation at medium and low temperature is 100% ~ 200%, elongation at high temperature is 700% ~ 800%). In the future, it is necessary to further strengthen the research on this kind of materials, which will provide support for the development of aviation and aerospace technology.

(8) New High-strength and High-plastic Casting Magnesium Alloy Materials

Cast magnesium alloy has the advantages of excellent casting property, machining performance, high specific strength and specific stiffness, etc. It has been widely used in the manufacture of aircraft skin, cabin, engine parts and other complex structure and large volume thin-walled parts. With the development of aviation, spaceflight, automobile and rail transit, there is a strong demand for thin-walled parts with light and complex structures. Therefore, it is significant to develop new casting magnesium alloy materials with high fluidity, excellent strength (tensile strength > 300 MPa) and high plasticity (elongation > 10%).

(9) Ultralight Mg-Li alloy materials

Mg-Li alloy, with a density of 1.35 ~ 1.65g / cm3, is an ultralight and highly plastic material. Mg-Li alloys have been used in the manufacture of armored conveyors, non-structural and sub-structural parts in the field of aviation and aerospace. Mg-Li alloy has been used in Russia to manufacture parts of electrical instruments and enclosures for spacecraft. In Japan, Mg-Li alloy is used for electronic products and acoustic diaphragm. In recent years, Mg-Li alloy has been used in the manufacture of satellite instrument shells. In the future, with the development of research and technology, ultralight Mg-Li alloys will be widely used in aviation, aerospace, automobile, computer, communication and consumer electronics.

(10) High performance high temperature resistant magnesium alloys

At present, high performance high temperature resistant magnesium alloy has been widely used in automobile engine cover, cylinder block, engine piston and cabin of high-speed aircraft. At present, most of the researches on high performance high temperature resistant magnesium alloys focus on the performance regulation of Mg, A1 and Zn systems and the alloying behavior of rare earth elements. Among them, the high temperature mechanical properties is best represented by Mg-Gd system. At present, it is urgent to solve the problem of increasing strength and plasticity simultaneously. Concrete measures include controlling the distribution of precipitates, refining the structure and reducing the impurity content. In addition, the castability of magnesium alloys should be emphasized, i. e., mechanical properties and castability should be considered in the design of alloys. In terms of performance index, ultra-high strength (strength > 400 MPa) and heat-resistant (working temperature > 250 ¬∞C) magnesium alloy is a key material which needs to be tackled urgently. With the continuous development of technology, high performance high temperature resistant magnesium alloys will be widely used in automotive power system components, aerospace vehicles and other areas of material strength, high temperature resistance and lightweight material requirements.

(11) New high performance magnesium matrix composites

General magnesium alloy materials have low absolute strength, low rigidity, poor wear resistance and creep resistance. It can be effectively solved by adding particles, whiskers or fibers. Moreover, by using the type, shape, size and content of reinforcement, the properties of magnesium matrix composites can be effectively controlled to meet the application requirements. At present, most magnesium matrix composites are prepared by powder

metallurgy method. The high quality and high efficiency of magnesium matrix composite is an urgent problem to be solved.

Development Goals and Strategies of China's Advanced Magnesium Alloy Material Industry

(1) Development Goals of the Advanced Magnesium Alloy Industry
Facing 2030, China's advanced magnesium alloy industry will establish a sound sustainable development innovation and application system, At the same time, the overall realization of large-scale and high degree of automation manufacturing, in R & D, production and application to reach a global high level, and even some of the related technology or products to reach the world level of precision. Most of the high end magnesium alloy materials needed in China are no longer dependent on imports and become self-sufficient. The ultra-high performance magnesium alloy materials at the high tip achieve external technical output and support, help global magnesium alloy industry to improve the overall level; Focus on upgrading equipment lightweight materials research and development capabilities and high-performance low-cost magnesium alloy complex precision machining capabilities; The nationalization rate of magnesium alloy materials for major national projects has reached 99%, promoting energy saving of over 30% and emission reduction of over 40% in the field of transportation.

Facing 2035, China's high-end magnesium alloy material industry as a whole in R & D, production and application to achieve global leading level, large-scale, intelligent, green manufacturing, global magnesium alloy industry to play a leading role. Realizing the industrialization of the next generation of high strength and toughness large-scale integral structure design and related equipment; We will achieve 100% nationalization rate of high-performance magnesium alloy materials for major national projects, and promote energy saving of over 40% and emission reduction of over 50% in the field of transportation.

(2) Industrial development strategies
1. Improve the capability of independent innovation, optimize the industrial chain and promote the application of industrialization

Centering on the core technology of advanced high performance magnesium alloy materials, efforts are made to improve the independent innovation ability, support the industrialization construction of magnesium alloy material urgently needed by major national projects through optimizing the organization and implementation mode, and promote the industrialization and scale application of a number of magnesium alloys. Establish a mechanism of complementary

advantages in the upstream and downstream of the industrial chain, shorten the cycle of R & D, industrialization and large-scale application, Promote magnesium alloy material enterprises to strengthen technological innovation, support a number of young and middle-aged innovation backbone with good research foundation to engage in original research, form a sustained innovation capacity, further enhance the innovation capacity of China's magnesium alloy materials industry. To realize the strategic transformation from material power to material power in China, to fully meet the needs of national economy, national major projects and social sustainable development for magnesium alloy materials.

2. Strengthen top-level planning, optimize resource allocation and cultivate superior products

At the top level of design, strengthen the national investment in the basic research of high performance magnesium alloy materials, increase the emphasis on advanced magnesium alloy material core technology in line with the world's high-level manufacturing. Efforts are made to break through the engineering problems of magnesium alloy industry development and improve the basic support capacity of magnesium alloys. We will speed up the improvement of policies and regulations conducive to promoting the development of the magnesium alloy material industry, formulate guidance catalogues and investment guidelines for the development and establishment of relevant technical standards systems, and improve the industrial chain, innovation chain and capital chain. Follow the principle of "who invests, who is responsible" and strengthen supervision over the rate of return on state-owned capital investment; We should focus on supporting key industries, prevent investment fragmentation, and focus on cultivating and shaping China's famous magnesium alloy products. At the same time, on the basis of paying attention to the government's strategic guidance for the development of advanced magnesium alloy materials industry, we will accelerate the creation of a market environment in which magnesium alloy material related enterprises operate independently and compete fairly. Take enterprises as the main body of investment and application of results, strengthen the combination of "production, study, research and application," perfect the construction of risk guarantee system, give full play to the basic role of market allocation of resources, improve the efficiency and fairness of resource allocation.

3. Strengthen cooperation among enterprises and expand application fields

Through multi-regional integration and capital cooperation to strengthen the cooperation between outstanding enterprises, help to form a certain influence in the world of well-known enterprise groups. At the same time, responding positively to the process of industrialization

reform in China, emphasis is placed on expanding the application field of magnesium alloy materials and expanding the consumption market of magnesium alloys materials in the material industry. At the same time, guide enterprises to carry out industrial restructuring and upgrading, improve product quality and expand production scale, strive to meet the world advanced manufacturing level, quickly help China's magnesium alloy materials in the world cutting-edge manufacturing field to occupy a place.

4. Strengthen the construction of "production, learning and research" and construct a complete research system of magnesium alloy materials

In the construction of "Production, Learning and Research," focus on the independent development and application of magnesium alloy materials for preparation and testing of high-end equipment, reduce the dependence on imported equipment, and promote the rapid, efficient and intelligent manufacturing process of magnesium alloys enterprises. A perfect research system for magnesium alloy materials is constructed, which integrates design, performance and evaluation, and speeds up the development process. Based on the end of magnesium alloy industry, a perfect material big data system is constructed to promote the formation of an applied research system comparable to the world's high level. At the same time, we will construct a set of independent intellectual property rights system related to the magnesium alloy industry that is compatible with China but is in line with international standards. Integrating property rights protection, innovation expansion and application, we will carry out adaptive production activities of related scientific research achievements in enterprises, and promote the development of magnesium alloy material industry to a high level.

5. Implement the strategy of developing innovative talents, improve the platform construction, and strengthen the talent team

In terms of talent and platform construction, we should implement the strategy of innovative talent development, and continuously increase the training of innovative talents in magnesium alloy material field. We will increase investment in scientific research, formulate incentive policies for scientific researchers, and focus on supporting a number of young and middle-aged innovators with a good research foundation to engage in original research so as to form a sustainable innovation capability. Support enterprises to strengthen innovation capacity building, establish a suitable talent development and salary system, attract domestic and foreign talent exchange and employment. At the same time, to magnesium alloy related enterprises to provide policy convenience for international exchanges, promote international cooperation, management and technical exchanges between enterprises, improve magnesium alloy

enterprises and the world high-end manufacturing integration. We will actively build an innovation platform of "production, learning, research and use" based on relevant industries of enterprises. We will bring together academicians and scientific and technological innovation leaders and other high-end innovative talents to play their leading role, make innovative talents and industries closely integrate, form a good innovation model and build a sustainable development research team.

V. Countermeasures

(1) Focus on the construction of research systems

To strengthen the planning of magnesium alloy material industry, follow the needs of national material industry strategic layout, and build a research system in line with China's national conditions. We should pay more attention to the core technologies in the R & D stage, especially the advanced magnesium alloy materials that are in line with the world's high-level manufacturing, and give policy preference and support to the development plan and process. At the same time, make full use of the advantages of big data, in China to build a set of magnesium alloy material R & D system closely linked with the world high-end manufacturing standards, integrating design, preparation, performance testing and evaluation of the integration of the overall promotion of domestic high-end magnesium alloys materials research and development process.

(2) Optimizing the pattern of industrial development

Relying on experts and scholars from universities and research institutes at home and abroad to carry out consultation, build a healthy and green development pattern integrating R & D, production and application. We should give full play to the independent regulation and control function of the consumer market, allocate resources rationally, and provide adequate financial support to key R & D enterprises. Also need to be in the initial stage and potential R & D enterprises to give certain support to form a common progress, common growth of industrial development pattern.

(3) Building High-quality and High-efficiency Industries

According to the national strategic needs, we will further enhance the relationship between scientific research achievements and enterprise production, promote the upgrading of

enterprises, and develop in the direction of high quality, high capacity, smart green and low cost. At the same time, focus on high-end performance magnesium alloy material technology research and development transformation, help high-end performance of magnesium alloy production with international high-end production level. At the same time, the production capacity of advanced magnesium alloy materials industry to meet domestic demand on the basis of exports, in the world to establish China's own high-performance magnesium alloy products brand.

(4) Improving the supporting policy system

In terms of investment, the state should increase support for enterprises engaged in industrial pilot upgrading and high-end performance magnesium alloy materials. At the same time, it will give preferential policies to enterprises in handling approval procedures for pilot production applications and related preferential policies. Build and gradually improve the supporting policy system between the state and enterprises, reduce the pressure and risk of enterprise production investment, enhance the enthusiasm of enterprise innovation production, give full play to the investment value of capital.

(5) Building a System of Elite Talents

In line with the international advanced high-end performance magnesium alloy materials research and development direction, to "go out, bring in, meet the demand" as the principle, implementation of talent introduction and development of strategic measures, build high-end performance of magnesium alloy related industry elite talent system. Strengthen training and support for young innovation teams, encourage them to learn and exchange with experienced domestic and foreign experts and scholars. At the same time, the introduction of foreign elite talent to give strong preferential policies and salary support, encourage them to come to China for technical exchanges and services. Enterprises can construct a standardized and efficient talent management system, cultivate a highly independent and innovative talent team that is suitable for enterprise production. Finally, strengthen the enterprise and scientific research institutions related experts and scholars contact, set up and enterprise counterpart elite talent reserve team, help enterprise talent system construction.

Thank you