



# Gansu Province Non-ferrous Metallurgical Industry Network Collaborative Manufacturing Development Strategy

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**Abstract.** At present, the development of non-ferrous metallurgy industry is influenced by internal and external factors. If we continue to follow the traditional development path, it will be difficult to meet the requirements of high-quality development of the industry at the new stage of development. With the rapid development of new technologies such as industrial internet, 5G and artificial intelligence, the non-ferrous metallurgical industry must accelerate its organic integration with new industries, industries, models and technologies, break through long-term development bottlenecks and explore new development models. Networked collaborative manufacturing has become an inevitable choice.

**Keywords:** non-ferrous metallurgy; networked collaborative manufacturing; Development strategy

## 1 Introduction

The Gansu non-ferrous metallurgy industry began in 1958, and a modern metallurgical production technology system was initially formed in 1978<sup>[1]</sup>. After the reform and opening up, the structural adjustment has made profound changes in the product structure and organizational form of the industry, and the introduction of foreign advanced technology and equipment has strengthened the comprehensive capacity of the non-ferrous metallurgical industry in Gansu Province, and the scale of the industry has been rapidly developing and expanding.

Gansu has developed into an important base for the non-ferrous metal metallurgy industry in the country by relying on its abundant mineral resources. But Gansu non-ferrous metallurgical industry is still "large and weak", the national key non-ferrous metallurgy new material base still has a long way to go.

Gap also means space for development. Especially the implementation of the "Belt and Road" strategy, the non-ferrous metallurgical industry as a "Belt and Road" Gansu

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section of the construction of one of the four major bases, is in the combination of advantages of the opportunity period, transformation and upgrading of the leaping period, the industry has great potential for development<sup>[2]</sup>.

## 2 Current state of industry development

### 2.1 Scale of industry

Gansu is one of the more mineral-rich provinces in the country. It has good mineral-forming geology, many kinds of mineral resources and abundant reserves. By the end of 2019, 180 minerals of all types (including Sub-minerals) have been discovered in the province<sup>[3]</sup>. Table 1: non-ferrous metallurgical mineral deposits by size for 2019 relying on rich mineral resources of non-ferrous metallurgy.

**Table 1.** Scale of Non-ferrous Metallurgical Mineral Deposits in 2019

name	total	large	medium	minor
copper mine	101	2	3	96
lead ore	6*9	3	6	60
zinc ore	67	6	7	54
magnesium ore	2	0	1	1
nickel ore	2	1	1	0
cobalt ore	15	1	2	12
tungsten ore	12	3	2	7
tin ore	4	0	1	3
bismuth ore	2	0	0	2
molybdenum ore	13	0	3	10
mercury ore	9	0	2	7
antimony ore	16	2	4	10
total	312	18	32	262

### 2.2 Industry contribution

According to statistics, from 2010 to 2021, the total value of non-ferrous metallurgy industry in Gansu Province increases by 3.4 times, from 80.445 billion yuan to 354.181 billion yuan. The non-ferrous metallurgy industry's contribution to the total economic volume of Gansu Province as a whole showed an upward trend, rising from 19.53% in 2010 to 34.58% in 2021.

### **2.3 Industrial distribution**

The mineral resources of Gansu Province are mainly concentrated in the northern mountainous area, Qilian Mountain area, Qinling Mountain in the west, Longdong area, followed by the Hexi Corridor, Longshou Mountain area and Altun Mountain area in the east. Non-ferrous metallurgical resources are relatively concentrated in spatial distribution characteristics<sup>[4]</sup>.

## **3 Existing problem**

### **3.1 Reducing resources and constraints to sustainable development**

Most of the minerals in Gansu Province, most of the mines are walking a "discovery - rise - insufficient backup resources - mineral depletion" path. Copper City Silver was once China's largest non-ferrous metallurgical industry base and the most important energy base in Gansu Province. Mineral resources reserves are decreasing day by day, which has become an important problem restricting the sustainable development of non-ferrous industry in Gansu Province.

### **3.2 Capacity retrospective, Excess pressure increases**

Currently, non-ferrous metallurgical product prices have recovered and entered a new upward path. In this situation, once the flexible production of aluminum electrolytic capacity is implemented to speed up the resumption of production, the rapid release of new generation capacity to be put into production, the growth in new project investment, the pressure for overcapacity continues to grow<sup>[5]</sup>.

### **3.3 Short industry chain and low value-added products**

Gansu Province for a long time, non-ferrous metallurgical industry generally has heavy mining light process phenomena, the resulting structure of industrial organization is overdispersed, low concentration of production, agglomeration development is not sufficient, industry support capacity is poor, low value added products.

## **4 Development strategy**

### **4.1 Basic principles of the strategy**

The first principle is adhere to the development principle of combining regional agglomeration and low carbon recycling. Gansu Province's non-ferrous metallurgical industry should promote energy conservation, emission reduction add efficiency reduction to the maximum extent in the process of implementing the network collaborative manufacturing strategy.

Follow the development principle of integrating intelligent manufacturing and business transformation. For the transformation and upgrading of the non-ferrous metallurgical industry as well as the transformation of the regional economy to consolidate the foundation, Gansu Province's non-ferrous metallurgical industry must adhere to the principle of combining enterprise transformation and intelligent manufacturing.

## **4.2 Strategic focus**

### **Accelerate the green and low-carbon transformation of industries.**

Promote the collaborative manufacturing model of symbiotic coupling network of enterprise groups in the resource recycling industrial chain, strengthen the industrial cycle links of enterprise groups, and promote the recycling of waste resources in enterprise groups. Build a resource recycling information service platform for enterprise clusters. Based on the intelligent decision-making platform of resource recycling, the intelligent optimization algorithm is applied to strengthen resource recycling and improve resource utilization efficiency.

### **Improve the digitization of infrastructure**

Plan and deploy Ethernet and wireless communication facilities in businesses, factories, and mining areas as a whole to improve the network communication capacity of mining areas and achieve full coverage of the industrial network throughout the mining area. Coordinate the upgrading of the internal network with the construction of the external network. Second, by integrating sensing, measuring, detecting, and controlling information, digital devices like environment sensing terminals are deployed in mines, smelting factories, and processing factories to realize real-time sensing of equipment, materials, production process, product quality, and safety environment. This enables the construction of multiple safety protection and guarantee systems under a single centralized management.

### **Promote the development of platforms for network collaboration**

Based on process cross-domain optimization technology, research and develop a network collaborative intelligent ore dressing platform with functions such as process optimization, dynamic production scheduling and energy consumption management. Use the core technology to build an AI algorithm model for "real-time tracking and online optimization of ore taste changes".

Build a network architecture that integrates production process data with enterprise resource management, advanced scheduling, laboratory management and other systems, and coordinate the process simulation of the production process, the intelligent optimization of production planning, and the data analysis of production scheduling in the production scheduling collaboration platform.

R&D database system, enterprise resource management system, laboratory management system, manufacturing execution system, safety and environmental protection

management system integrated system. Real-time mastery of equipment status, real-time monitoring of key equipment related data.

### 4.3 Strategic support

#### **Effective strengthening of organizational leadership**

In-depth implementation of the CPC Central Committee, the State Council and the provincial government decision-making and deployment, strengthen the leadership of Gansu Provincial Science and Technology Department, Gansu Provincial Department of Industry and Information Technology, to establish and improve the coordination mechanism to promote the development of the strategy, to do a good job in organizing, coordinating and guiding the promotion of the work, and to resolve in a timely manner the non-ferrous metallurgical industry network synergistic development of the major issues that arise in the course of the implementation of the strategy.

#### **Promote institutional innovation in market mechanisms**

Explore management and operation strategies that will optimize the allocation of non-ferrous metallurgical resources and the effective operation of the non-ferrous metallurgical market. Deepen institutional reform of novel market mechanisms. In order to achieve the best resource allocation overall, coordinate worldwide in accordance with the collaborative supply chain system of the non-ferrous metallurgy network<sup>[6]</sup>. Make the most of available resources, technology, and money, and create a new market competition ecology where large, medium, and small businesses are interdependent and mutually supportive of one another<sup>[7]</sup>.

#### **Increase industrial financing support**

Implement the policy objective of providing synergistic platforms top attention when planning big national initiatives. To create a "finance, investment, and loan" support model that fuses stable support with project support, local support with central support, and financial capital investment with enterprise and social capital investment<sup>[8]</sup>. Encourage financial institutions to work closely with industrial Internet platforms and service providers to help the non-ferrous metallurgical sector go digital. In addition, give non-ferrous metallurgical businesses partial or full interest rate subsidies if they use special loans or other financial products to go digital<sup>[9]</sup>.

#### **Enhancement of key technology R&D capabilities**

Accelerate the key technological breakthroughs in the production process and network synergistic intelligent integration platform of the non-ferrous metallurgical industry, and enhance the independent innovation capability of enterprises. First, increase the investment and intensity of basic research of non-ferrous metallurgical enterprises. The second is to actively establish non-ferrous metallurgy industry-related joint laboratories, joint technology centers and other cooperation modes with universities and other research institutions.

### **Improve mechanisms for talent development**

Funding and support for diversified talent training should be increased. Encourage universities, research organizations, and businesses to work together to develop compound talents in the areas of non-ferrous metallurgy and information technology, and develop a talent-cultivation model that integrates business, government, and academia. Create various talent incentive modes in accordance with the requirements of various talents based on the "Gansu Provincial Science and Technology Reward Measures"<sup>[10]</sup> and other talent incentive policies.

## **5 Conclusions**

This thesis consists of three parts: current situation of industrial development, existing problems and development strategy. The first part firstly reviews the development history of the non-ferrous metallurgy industry in Gansu Province, and then analyses the development of its industrial scale, its contribution to the national economy, and the spatial layout of the industry. The second part analyses the current problems of the non-ferrous metallurgy industry in Gansu Province, and finds that there are major problems such as resource reduction, overcapacity, low value-added products, and so on. Based on the analysis of the first two parts, the third part clarifies the basic principles, establishes the strategic tasks such as accelerating green and low-carbon transformation, digital construction, network platform construction and application, etc., and designs the support framework for the implementation of the strategy in terms of organisational leadership, institutional innovation, investment and financing efforts, key technology research and development, and talent cultivation.

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