Current Status and Development Trends of China's Alumina Production Technologies

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Abstract

In recent years, China's alumina industry has experienced rapid development, with significant increases in both production capacity and output. Substantial progresses have been made in areas such as efficient resource utilization, green and low-carbon development, and digital intelligence. This paper provides an overview on the production status of China's alumina industry, analyses the future key challenges in achieving high-quality development, and outlines the major research directions for future technological advancement, which include the efficient utilization of low-grade bauxite resources, the development of non-bauxite aluminium-bearing materials, green calcination of aluminium hydroxide, full-process digitalization and intelligentizing, and large-scale bauxite residue disposal. The study aims to provide a reference for technological innovation and sustainable development in the alumina industry.

Keywords: Alumina, Efficient Resource Utilization, Green and Low-Carbon, Digital Intelligence, Trends

1.   Introduction

In recent years, the global alumina industry has experienced rapid growth, with continuous increases in both production capacity and output. In 2024, global alumina capacity exceeded 180 million tonnes, with production surpassing 140 million tonnes. Among these, China's alumina capacity reached 107.3 million tonnes, with output totalling 85.52 million tonnes. Under China's national strategy background of carbon peaking and carbon neutrality, and the construction of a digital China, green, low-carbon transformation and digital intelligence empowerment have become the two major themes in the development of China's alumina industry. Particularly under the global trend toward green and digital intelligence development, China's alumina industry faces a series of new challenges, including the deterioration of bauxite resources, intensified environmental pollution, increased complexity in production management, and labour shortage. There is an urgent need to accurately identify and analyse technological breakthrough directions in the efficient use of bauxite resources, low-carbon process innovation, and digital transformation. This will enable scientific and technological innovation to drive industrial advancement and support the high-quality development of the traditional alumina industry [1].

Therefore, based on a systematic review of domestic and international alumina production and technological development, this paper analyses key technical bottlenecks and future development trends, with the aim of providing a reference to technological progress and sustainable growth of the alumina industry.

2. Current Status of China's Alumina Industry

2.1 Production Capacity and Output

In 2024, China's alumina production capacity reached 107.3 million tonnes, mainly distributed in the provinces of Shandong, Shanxi, Guangxi, and Henan. Among them, Shandong accounted for 33.7 million tonnes (31.41 %), Shanxi 26.45 million tonnes (24.65 %), Guangxi 17.1 million tonnes (15.94 %), and Henan 11.65 million tonnes (10.86 %). The distribution of alumina production capacity across provinces is shown in Figure 1.
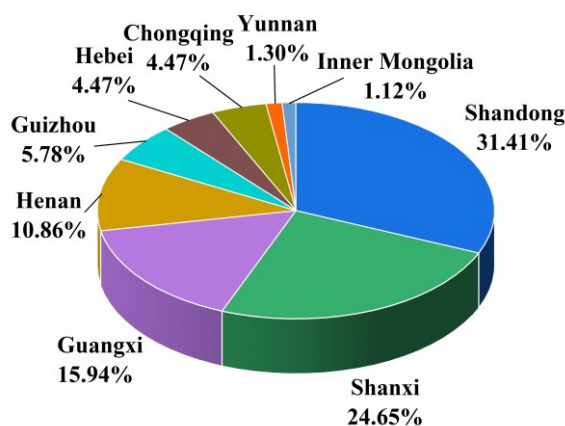

Figure 1. Distribution of alumina production capacity by province in China.

In 2024, China's alumina output totalled 85.52 million tonnes. The top three producing provinces are Shandong, Shanxi, and Guangxi, which altogether contributed 76.21 % of the nation's total. Shandong produced 29.60 million tonnes (34.61 %), Shanxi 20.33 million tonnes (23.78 %), and Guangxi 14.54 million tonnes (17.00 %). The distribution of alumina output across provinces is shown in Figure 2.
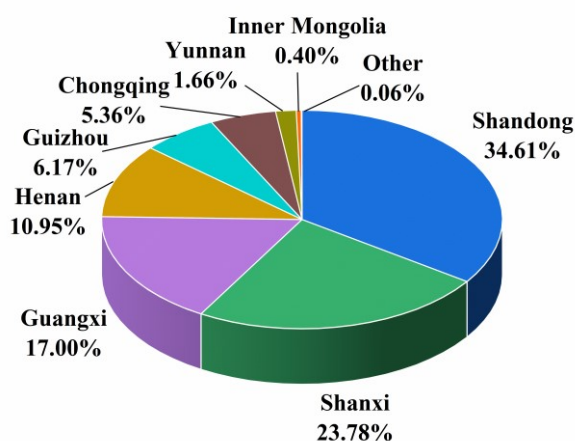

Figure 2. Distribution of alumina output by province in China.

accelerating the promotion and application of advanced technologies and supporting the sustainable growth of the alumina industry.

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