RESEARCH ARTICLE

Application of Pressurized Hydrometallurgical Technology in Zinc Smelting

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Abstract: In the specific smelting process of non-ferrous metals, hydrometallurgy technology is widely used in this field and plays an important role. Modern hydrometallurgical technology covers a wide range of fields. Except for steel, other related non-ferrous metals can be refined by this method. It has great adaptability in many fields. This article briefly introduces the pressurized hydrometallurgy technology in zinc smelting, hoping to bring some inspiration to everyone.
Keywords: Zinc; hydrometallurgy; application

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1 Introduction

Zinc is a metal element next to iron, aluminum and copper, which plays a very important role in modern industry. China's zinc resources are abundant in reserves, ranking first in the world. At the same time, it is the largest zinc producer in the world, and China's zinc output has been ranked first in the world for many years. In recent years, China's zinc smelting technology has developed very rapidly, and has gradually reached the international advanced level. The application effect of pressurized hydrometallurgy technology in zinc smelting is very good.

2 Specific Development of Hydrometallurgy

Hydrometallurgy refers to a main process of hydrometallurgy of metals on the basis of pressurization. Under the condition of pressurization, the boiling point of metal solution will be higher, which can gradually increase the metallurgical process of metal and change the specific conditions of previous mechanical reaction, so it can greatly promote the smooth progress of chemical reaction and further enhance the productivity of metallurgy. Pressurized hydrometallurgy technology was first put forward in 1887. Before that, the traditional method was to implement a certain pressure in the autoclave, leach bauxite with sodium hydroxide to obtain a solution such as sodium chlorate, and obtain the corresponding alumina by certain separation. It was not until 1940 that the pressurized hydrometallurgy technology was further developed. According to the related research, in the oxygen environment, the direct leaching can be realized without oxidizing and baking the specific sulfide ore containing copper, nickel and other metal elements, and the leaching effect will reach the maximum under the condition of pressure. In 1970, the pressure acid leaching technology also made great progress in the specific treatment of zinc concentrate, which could further transform the sulfur compounds in the concentrate into elemental sulfur. And can well realize the specific separation process of sulfur and zinc production. It makes the development of pressure leaching and other technologies deeper. Looking at the concrete development of our country in recent years, China has also made great contributions to the pressure wet smelting technology. Since 1980, China has been deeply studying the specific pressure leaching of zinc concentrate. However, the research is only done in the laboratory, and it is not really invested in the actual industry. Although we negotiated with some foreign developed countries, we hoped to introduce more advanced technology, but because of the high cost, it could not be fully realized. Since then, at the end of the 20th century, Yunnan metallurgical technology has made a great breakthrough in the

research of specific pressure leaching of zinc concentrate, and its application field has also been greatly expanded. The pressure hydrometallurgy technology belongs to a relatively advanced technology, and its appearance time is not very long. However, due to its own characteristics, its cost is relatively small and it will not cause great damage to the environment [1]. Therefore, the pressurized wet smelting technology has a very good development prospect, but there are still many imperfections and defects in this technology, and it still needs specific research and improvement by relevant researchers.

3. Specific Direct Oxygen Pressure Acid Leaching Scheme of Zinc Concentrate

3.1 Related development of zinc smelting technology

The smelting process of zinc can be roughly divided into two types: combustion method and wet method. Because of its obvious advantages, the latter gradually replaced the previous pyrometallurgy and became a main method in zinc smelting list. Basically, new and expanded zinc smelting enterprises generally adopt specific wet smelting process. The traditional zinc hydrometallurgy was officially applied in industrial production in the early 20th century. In the process of continuous development, the process technology has made remarkable progress. In the 1960s, the emergence of high-temperature and high-acid leaching technology and a brand-new iron removal method effectively completed the treatment of leaching residue, and at the same time greatly improved the recovery rate of zinc, further reduced the environmental pollution and promoted the maturity of technology. Undeniably, compared with the traditional zinc hydrometallurgy process, there are many defects, and it is necessary to ensure the simultaneous production of zinc and sulfuric acid in the smelting process [2]. Faced with this situation, not only the composition of raw materials needs to be strictly required, but also there are some problems such as complicated technological process and large cost and investment, which are difficult to be widely popularized. In the face of this situation, further innovation can be made on the basis of the traditional zinc hydrometallurgy process, which has become the focus of relevant researchers. In the 1970s, Canadian companies proposed that zinc concentrate could be leached directly without roasting by combining specific oxidation with pressure acid leaching. Compared with the traditional zinc hydrometallurgy process, the cost is very low. In 1981, the world's first pressure leaching equipment was put into operation. After continuous development, zinc pressure metallurgy technology has been greatly improved.

3.2 Specific oxygen pressure direct acid leaching

The traditional wet zinc smelting actually needs to be gradually developed on the basis of fire smelting. The pyrometallurgical and hydrometallurgical processes have been integrated, which can be divided into several processes such as roasting, leaching, purification, electrolysis and acid making. The main principle is that dilute sulfuric acid can be used to dissolve zinc in zinc oxide and zinc sulfate. However, in order to further reduce the specific problems of air pollution, it is necessary to implement roasting desulfurization in advance, and the corresponding acid system and flue gas treatment system must be equipped. However, the production process is rather cumbersome and the cost is relatively high. After 1970s, the pressurized hydrometallurgy technology made great progress in the specific treatment of zinc concentrate. Compared with the traditional zinc hydrometallurgy process, the economic benefit will be better. The advantages of hydrometallurgy under pressure: the sulfur in mineral raw materials is further converted into elemental sulfur, thus realizing the separation between zinc production and sulfuric acid production [3].

The process of oxygen pressure leaching mainly includes two stages. The first stage of oxygen pressure leaching mainly needs to use waste electrolyte to leach the corresponding zinc concentrate. The initial acid concentration is about 150g/L, and the leaching rate of zinc can reach more than 98% to a great extent. The acid concentration of the residual solution can still be as high as 40g/L, which requires neutralization. Usually, residual acid can be used to leach zinc oxide to increase zinc output, which is very common in the expansion of traditional wet zinc smelting enterprises. The first stage of two-stage oxygen pressure leaching belongs to low acid leaching, with acid concentration of 70-80g/L, residual acid of 5-10g/L and zinc leaching rate of 70%-75%. The leaching residue in the reaction will enter the second stage of pressure leaching, which can increase the acid concentration to 150g/L. After the crude sulfur is treated correspondingly, the corresponding elemental sulfur can be formed, and the leaching solution can be used as the leaching agent in the first stage, in which the leaching rate of zinc can reach more than 98%.

3.3 Specific development of pressure leaching technology

3.3.1 Specific pressure leaching technology of high-silicon zinc oxide

High-silicon zinc oxide is difficult to be reliably sep-

arated by conventional mineral processing methods. Although pyrometallurgical zinc technology can be used, it has the problems of high energy consumption and serious pollution, therefore, the wet process has attracted extensive attention. In the face of the shortcomings of alkaline leaching and atmospheric acid leaching, in the long-term research, a specific technology of leaching high-silicon zinc oxide under high pressure was gradually put forward, and the leaching rate of zinc could be as high as 98.5% under appropriate technological conditions. In 2007, the continuous pressure acid leaching technology of high-silicon zinc oxide process was further developed, and the industrial continuous production was realized. This process has the characteristics of simple process, fast reaction and easy control, which can well realize the complete separation between zinc and silicon. The silicon content of the leaching solution is relatively low, and no additional treatment is needed, so it has a good promotion prospect [4].

3.3.2 Specific recovery process of lead-zinc sulfide mixed ore

For some relatively complex lead-zinc ores, because of the long beneficiation process and low recovery rate, only lead-zinc mixed ores can be produced. Until the middle of the 20th century, relevant researchers in the UK put forward the ISP method, which can well treat mixed lead-zinc sulfide ore and better realize the production of lead and zinc. However, this method needs to use a lot of coke, which has great energy consumption and serious pollution, and has not been widely promoted. In the continuous development, the oxygen pressure leaching process has been widely used.

4Conclusion

In short, zinc is an important industrial raw material in economic development and plays a very important role in China. Only by constantly innovating and developing smelting technology can we keep pace with the times and achieve sustainable development.

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