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Technical guidelines for the recycling of strontium-containing waste residue

含锶废渣回收技术指南

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Foreword

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1.Scope This document provides guidance on the composition, recycling methods, recycling effects, and environmental protection of strontium-containing waste. This document applies to the recovery technology for the production of industrial strontium chloride hexahydrate from strontium-containing waste residue.

4.Composition of Strontium-containing waste residue The main components are strontium carbonate, silicate, residual strontium sulfate, strontium sulfide and calcium carbonate, etc.

5 Recycling methods

5.1 Principle Strontium-containing waste reacts with hydrochloric acid to produce a solution containing strontium chloride. After purification and impurity removal, the solution is obtained through evaporation crystallization, solid-liquid separation, and drying. Strontium chloride hexahydrate.

5.2 Process Flow

5.2.1 Overview After grinding the strontium-containing waste residue with water to the required fineness, a strontium-containing waste residue slurry is prepared according to a certain liquid-solid ratio. Hydrochloric acid is then introduced into the slurry. The material is processed through chemical reaction and filtration. The filtrate is a crude strontium chloride solution. The filter residue is washed and transported to the slag yard, while the washing

water is returned to the grinding stage. After impurity removal and refining, the washing water from the impurity removal process is reused in the ball milling process; the refined solution is filtered, evaporated for crystallization, separated, and dried to obtain... Strontium chloride hexahydrate.

5.2.2 Flowchart The process flow diagram for the production of strontium chloride hexahydrate from strontium-containing waste residue is shown in Figure 1. Figure

1.Flowchart of the process for producing strontium chloride hexahydrate from strontium-containing waste residue.

5.3.1 Grinding

5.3.1.1 When the material is crushed in a ball mill, it is mixed with water to make a strontium slag slurry with a solid content of about 20%.

5.3.1.2 After grinding, the particle size of the strontium slag should preferably not exceed 125 μm (approximately 120 mesh).

5.3.2 Chemicals

5.3.2.1 Add 30% hydrochloric acid to the strontium residue in the leaching tank, and control the temperature to not exceed 80 °C; stop leaching when the pH of the solution reaches 3~4. Stop adding acid and maintain this state for 30 minutes. The total reaction time should be controlled within 3 to 4 hours.

5.3.2.2 When the pH of the solution in the chemical tank reaches 5~6, it enters the filtration A process for filtration.

5.3.2.3 The filtrate enters the desulfurization and iron removal process; the filter residue is discharged after washing, and the washing water is returned to the ball milling process.

5.3.3 Washing and Refining

5.3.3.1 In the desulfurization and iron removal process, industrial hydrogen peroxide is added to oxidize the sulfur and ferrous ions (Fe^{2+}) in the feed solution.

5.3.3.2 During the pH adjustment and aluminum removal process, add a 30% sodium hydroxide solution to adjust the pH of the solution to 7-9, thereby removing iron and aluminum from the solution. After complete sedimentation, the mixture proceeds to filtration step B for further filtration.

5.3.3.3 The filtrate (5.3.3.2) enters the calcium and magnesium removal process. The filter residue is discharged after washing, and the washing water is returned to the ball milling process.

5.3.3.4 In the calcium and magnesium removal process, the amount of strontium hydroxide

added is determined based on the calcium content in the filtrate, maintaining the pH at 10-12, and then the process is initiated. Heat the sample to 90°C to promote complete precipitation of magnesium ions, then proceed to the filtration process C for filtration.

5.3.3.5 The filtrate (5.3.3.4) enters the acid conditioning process, the filter residue is a calcium-magnesium paste that can be used for desulfurization, and the washing water is returned to the ball milling process.

5.3.4 Acid adjustment and filtration Hydrochloric acid is added during the acid adjustment process to adjust the pH of the solution to 7-8; the solution then proceeds to the filtration step D, and the filtrate is then used for the evaporation process.

5.3.5 Evaporation and Crystallization

5.3.5.1 In the evaporation process, the strontium chloride solution is concentrated to a concentration higher than 60% before entering the cooling crystallization process.

5.3.5.2 The cooling crystallization temperature in the cooling crystallization process should be lower than 40 °C.

5.3.5.3 The mother liquor after solid-liquid separation is returned to the calcium and magnesium removal process to further remove calcium from the mother liquor.

5.3.5.4 In the drying process, the drying temperature should be controlled at around 60 °C.

5.4 Main Equipment Ball mills, reaction vessels, storage tanks, evaporation and crystallization equipment, solid-liquid separation equipment, drying equipment, and finished product packaging machines, etc.

6.Recycling effect It is crucial that the strontium chloride hexahydrate product produced from strontium-containing waste meets the requirements of HG/T 4501.The recovery rate of acid-soluble strontium is also important. It should be greater than 50%. For relevant measurement and calculation methods, please refer to Appendix A.

7 Environmental Protection

7.1 Wastewater In the process of recovering strontium-containing waste residue, it is very important to recycle wastewater and reuse it in the production process.

7.2 Exhaust Gas The waste gas generated during the recycling and utilization of strontium-containing waste residue is comprehensively treated to achieve standard emissions, which is a very important step.

7.3 Waste residue Waste residue generated during the recycling of strontium-containing waste residue shall be identified in accordance with GB 5085.7, and compliance with the following requirements is crucial. Yes.

a) If identified as hazardous waste, it should be subjected to advanced harmless treatment according to its own conditions, or handed over to a qualified professional hazardous waste disposal company. The relevant management agency will handle the matter.

b) If identified as general solid waste, it shall be disposed of in accordance with the provisions of GB 18599.