

# 新型干法硫铝酸盐水泥熟料生产技术

## PROCESS AND TECHNOLOGY OF SULPHOALUMINATE CEMENT



### 主要技术优势

#### Main technical advantages

- 提供1000~2500t/d的大型化硫铝酸盐水泥生产工艺技术
- 熟料烧成热耗低
- 熟料质量高
- 工艺技术成熟可靠
- 窑系统运行稳定
- 全面、系统的技术服务
- to provide process and technology of sulphoaluminate cement with capacity of 1000~2500t/d clinker
- low heat consumption
- high clinker quality
- reliable and sophisticated process and technology
- reliable operation of clinker burning system
- overall and systematic technical service

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## 1 概述

### GENERAL

硫铝酸盐水泥是我国自主研发的一种特种水泥，是我国四大特种水泥品种之一。广泛应用在GRC制品、自应力水泥压力管、普通排水管，以及冬季施工、抗渗堵漏、抢修抢建等特殊工程等方面。

目前硫铝酸盐水泥主要采用小型干法中空窑、立筒预热器窑、悬浮预热器窑等比较落后的工艺进行生产，日产量不超过600吨，虽然能够获得较高质量的熟料，但热耗普遍较高，熟料的标准煤耗高达160-200kg/吨熟料。近年来国内一些企业开始尝试利用新型干法预分解窑技术煅烧硫铝酸盐水泥熟料，并取得了进展，但是生产规模仍然很小，最大设计能力只有日产1000吨，由于在技术细节方面存在许多缺陷，实际运行时最大的能力只有日产800吨。而且这些利用预分解窑生产的企业目前普遍存在分解炉塌料、熟料游离钙高、熟料质量不稳定等问题。

我公司长期从事新型干法预分解窑熟料煅烧技术的研究和设计，利用我们已经掌握的普通硅酸盐水泥新型干法生产技术，经过适当的工艺参数调整和特殊设计，形成了一套适应硫铝酸盐水泥熟料的生产工艺技术，完全能够生产高质量的硫铝酸盐水泥熟料。

Sulphoaluminate cement is a type of special cement independently developed by China, and it is one of the 4 types of special cement. It is widely applied in GRC products, self-stress cement pipe, ordinary drainage pipe, leakage stoppage, construction in winter, rush repair and construction and similar special projects.

Presently, sulphoaluminate cement is mainly produced by means of small dry process hollow kiln process, shaft kiln process, suspension preheater process and similar out-dated process. The maximum capacity of such process is not exceeding 600t/d. Although it receives higher clinker quality, it is of higher heat consumption. The standard coal consumption is 160-200kg/t clinker. In recent years, some companies tried and made progress in using new dry process precalcining process to produce sulphoaluminate cement, but in small capacity. The maximum design capacity is 1000t/d only. Due to some shortcoming in technical details, the actual operated capacity is only 800t/d and also of problems of material collapse in calciner, higher free lime in clinker, instable clinker quality.

TCDRI keeps on research and design of new dry precalcining process. Based on existing process to produce ordinary Portland cement, after proper adjustment and special design on process parameter, it formed a complete set of process and technology for sulphoaluminate cement, which is able to produce high quality sulphoaluminate cement.

## 2 技术特点

### TECHNICAL CHARACTERISTICS

#### 1、生料制备

采用立磨粉磨系统制备生料。立磨系统烘干能力强的特点，对于铝矾土、脱硫石膏等含有一定水分的硫铝酸盐水泥原料的烘干具有良好的适应性。

#### 2、熟料烧成系统

烧成窑尾采用单系列五级旋风预热器和TTF分解炉。针对硫铝酸盐水泥熟料形成时产生的废热量明显小于普通硅酸盐水泥的特点，分解炉容积和截面面积有针对性的调整，确保分解炉内气体流速在适宜的范围，防止分解炉塌料的产生。新型干法预分解窑尾其它一些先进的技术也可以采用到硫铝酸盐水泥熟料的生产技术中，比如C4料管分料、采用流态化风机等。

烧成窑头燃烧器采用新型双旋流煤粉燃烧器，送煤风内外均设置旋流风，强化了煤粉和高温二次风的混合，具有灵便快捷的火焰调节手段，可使火焰形状以及煅烧温度，满足硫铝酸盐熟料形成时液相量少、主要以固相反应为主的特殊要求。

在管道设计和风机选型上有特殊的考虑，确保硫铝酸盐水泥熟料形成时窑内有足够过剩空气系数，避免出现还原气氛，避免出现硫铝酸盐熟料形成中最致命的“跑硫”现象。

#### 3、熟料冷却系统

选用全新的第四代篦式冷却机对硫铝酸盐熟料进行冷却，不仅使热回收效率大幅度提高，而且能够确保熟料的快速冷却。第四代篦式冷却机的结构特点，完全能够适应硫铝酸盐熟料容重小、粉料多的特点，并可使熟料温度冷却至100℃以下。

#### 1) RAW MEAL PREPARATION

It will use vertical roller mill (VRM) to produce raw meal. The characteristic of VRM is of strong drying capacity and of satisfactory adaptation to moisture contained raw material of sulphoaluminate cement, including bauxite and desulfurized gypsum.

#### 2) CLINKER BURNING SYSTEM

Single string 5-stage preheater system and TTF calciner will be employed. Regarding to the situation that substantial reduction of exhaust gas when producing sulphoaluminate cement comparing with ordinary Portland cement, the volume and sectional area of calciner is redesigned accordingly in order to ensure the gas velocity to be kept in a proper range, and avoid material collapse. Some advanced technology of new dry process precalcining of ordinary Portland cement can be also applied into process of sulphoaluminate cement, such as C4 duct for distribution, fluidized fan and etc.

Kiln burner uses new type double swirl coal burner. Pulverized coal channel was surrounded by swirl air and enhance mixing between pulverized coal and high temperature secondary air. Such burner is of flexible and quick flame regulation which enables flame shape and combustion temperature to fulfill special requirement of sulphoaluminate cement which creates less liquid phase and dominates by solid state reaction.

It is specially considered in ducting design and fan selection, in order to ensure enough excessive air factor, avoid occurrence of reducing atmosphere and forming “sulphur leaking” when producing sulphoaluminate cement

#### 3) CLINKER COOLING SYSTEM

The 4th generation grate cooler is used as the cooling equipment of sulphoaluminate cement. It can not only greatly improve the heat recovery efficiency, but also ensure quick cooling of clinker. The structure characteristics of the 4th generation grate cooler can fully adapt to features of sulphoaluminate cement, such as less bulk density, more powdery material and reduce the clinker temperature down to below 100°C.



生产硫铝酸盐使用的铝矾土（原料）  
Bauxite (raw material of sulphoaluminate cement)



硫铝酸盐水泥熟料的外观  
Clinker of Sulphoaluminate Cement

### 3 效果 EFFECT

#### 1. 生料制备电耗

细度在  $80\ \mu\text{m}$  筛筛余 8-10% 时，系统的电耗为 20KWh/t，比硫铝酸盐水泥企业普遍使用的球磨机系统节电 10KWh/t 左右。

#### 2. 熟料烧成热耗

熟料烧成热耗：110kg 标煤/吨熟料，比干法中空窑降低 100-110kg 标煤/吨熟料，比立筒预热器窑降低 70-80 kg 标煤/吨熟料，比五级悬浮预热器窑降低 40-50 标煤/吨熟料，能耗指标大幅下降。

#### 3. 熟料质量

达到中空窑、立筒预热器窑以及悬浮预热器窑的熟料质量水平。

#### 1) POWER CONSUMPTION OF RAW MEAL PREPARATION

When the fineness is 8~10% residue at  $80\ \mu\text{m}$ , the system power consumption is 20KWh/t cement, saving 10KWh/t cement comparing with that of generally used ball mill system.

#### 2) HEAT CONSUMPTION OF CLINKER BURNING SYSTEM

Clinker heat consumption is 110kg standard coal/t clinker, saving 100-110kg standard coal/t clinker comparing with dry process hollow kiln, 70-80 kg standard coal/t clinker reduced than shaft kiln system, and 40-50 standard coal/t clinker lower than 5-stage suspension preheater system.

#### 3) CLINKER QUALITY

In reaching the quality level of hollow kiln, shaft kiln and suspension preheater system.

### 4 实际应用

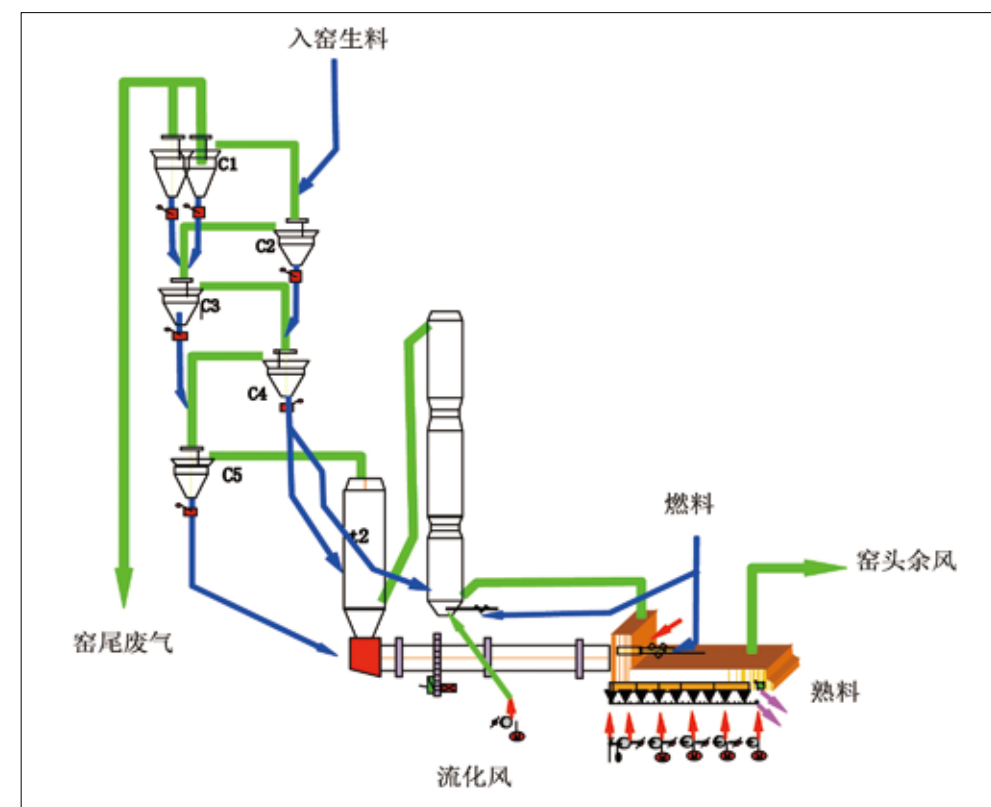
## APPLICATION REFERENCE

唐山六九水泥有限公司是硫铝酸盐水泥生产中规模较大、工艺较为先进的生产线之一。采用五级悬浮预热器窑生产技术，设计指标为 600t/d，实际运行煤耗为 158kg 标煤/吨熟料，相对于普通硅酸盐水泥熟料烧成工艺，仍然是比较落后的。为满足业主提高熟料产量的要求，我们利用新型干法水泥生产技术对烧成系统进行全面改造，改造为新型干法预分解窑系统，使生产线达到日产 1200 吨的能力，煤耗下降为 110kg 标煤/吨熟料。

系统的主要方案和流程见下图所示：

Tangshan 69 Cement Co., Ltd is the one of large capacity and advanced technology in producing sulphoaluminate cement. It consists of 5-stage suspension preheater system with design capacity of 600t/d and the actual coal consumption is 158kg standard coal/t clinker. Comparing with ordinary Portland cement, such technology is out dated. In order to fulfill the requirement of increasing clinker capacity, we utilize new dry process of cement production to completely modify the burning system of sulphoaluminate cement. It will be modified to new dry process precalcining system reach capacity of 1200 tons clinker per day, and coal consumption reduced to 110kg standard coal/t clinker.

The system flow sheet is as the following:







现有的硫铝酸盐水泥厂概貌  
Existing Sulphoaluminate Cement Production Line



未来新型干法硫铝酸盐水泥生产线  
Future Sulphoaluminate Cement Production Line



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