

# 燃煤催化剂

## COAL COMBUSTION CATALYST



### 主要技术优势

#### Main technical advantages

- 煤种适应性好，可适应于多种新型干法水泥窑用煤，对质量较差的劣质煤也能取到较好的燃烧效果；
- 本技术适用于各种窑炉特别是新型干法水泥窑，所含的微量元素能降低熟料烧成熔点，使液相提前出现，同时降低水泥熟料的烧成热耗并提高熟料的强度；
- 起到节煤和减少污染物排放的综合作用，节煤4~10%，氮氧化物减少10%以上；
- 针对水泥厂不同工艺、不同的煤种有不同的配方；
- 并且在使用过程中根据水泥厂需求还在调节配方；
- 可针对水泥厂原、燃料特点进行各种检测分析。
- to have wide adaptability to all types of coal, appropriate for multi-types of new dry process cement production and have better combustion effect to inferior coal;
- appropriate for different types of process, especially for new dry process cement kiln, contained trace element can reduce clinker melting point and make liquid phase to be presented in advance. Besides, it reduces the heat consumption of clinker and improves the strength of clinker;
- to play comprehensive function of coal consumption saving and pollutant emission reduction, coal saving 4~10%, NOx emission reduced over 10%;
- different formula regarding different process and types of coal;
- to be adjusted according to requirement of client;
- to perform inspection and analysis according to raw material and fuel condition.

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1 概述

GENERAL

水泥生产发展到今天，已经进入了以新型干法水泥生产线占主导地位的时代，但新型干法生产技术仍在继续发展和进一步完善中。近几年来，随着我国经济建设和社会的快速发展，对能源的需求量越来越大。在目前煤炭供应日趋紧张的形势下，作为用煤大户，大多数水泥生产企业都急切寻求降低煤耗，控制成本的办法。

公司为此开发了一种由助燃剂、增氧剂、分散剂、稳定剂、膨松剂等组成的燃煤催化剂产品，此种催化剂添加量为原煤用量的万分之一到万分之五，对熟料质量和窑设备等都无影响，起到提高煤的活性、降低着火温度、增加发热强度、提高煤的燃尽特性、使煤的燃烧更加充分等作用。从而使窑工况稳定性提高，窑结皮减少，窑投料量增加，NOx排放量减少，熟料强度提高并且达到节煤增产的目的。

Nowadays new dry process cement production has dominated in cement industry. However, it needs continuous development and further improvement. In recent years, with rapid development of economic and social development, the energy demand of China is becoming more and more urgent. Owing to less supply of coal, most of cement producers are seeking ways to reduce coal consumption and operational cost.

A type of coal combustion catalyst, consisting of combustion improver, oxygenates, dispersant, stabilizer and leavening agent was developed by our company. The catalyst takes 0.01%~0.05% of coal consumption without impact to clinker quality and rotary kiln operation. It can improve the activity of coal, reduce ignition temperature, increase calorific intensity, improve coal burnability and reach more sufficient combustion of coal. Besides, it can stabilize operation of kiln, reduce kiln coating, increase kiln feed, reduce NOx emission, improve clinker strength and reach the target of coal saving and production increasing.

2 产品介绍

PRODUCT INTRODUCTION

(1) 产品性状

黑色乳液，与水混溶。

(2) 产品组成

本产品为水泥工业用燃煤催化剂，由助燃剂、催化剂、增氧剂、分散剂、膨松剂等组成。

(3) 使用范围

本产品适用于新型干法水泥窑，使用催化剂后，可放宽对煤的质量要求，对质量较差的劣质煤也能起到较好的燃烧效果。

(4) 用量

本品与煤的比例为万分之一到万分之五。

催化剂的添加量对催化效果影响较大，用量不足催化效果微弱，用量过大时，催化剂包裹在炭表面，堵塞气孔，导致煤的燃烧效果下降，因此不同的煤种都有一个最佳的添加量。

(5) 使用效果

加入本产品后，煤粉燃尽率提高，窑工况稳定性增强，窑结皮减少，窑投料量增加，NOx排放量减少，熟料标煤耗降低，熟料强度提高。本产品无毒无腐蚀性，不会对烧成系统设备及煤磨产生任何负面影响。

I. PRODUCT CHARACTER:

Black emulsion, soluble to water

II. PRODUCT COMPOSITION:

The coal combustion catalyst is composed of combustion improver, oxygenates, dispersant, stabilizer, leavening agent and so on .

III. APPLICATION SCOPE:

It applies to new dry process cement kiln. With the addition of the coal combustion catalyst, the quality requirements of the coal can be modified. What's more, the combustion efficiency is good even for inferior coal.

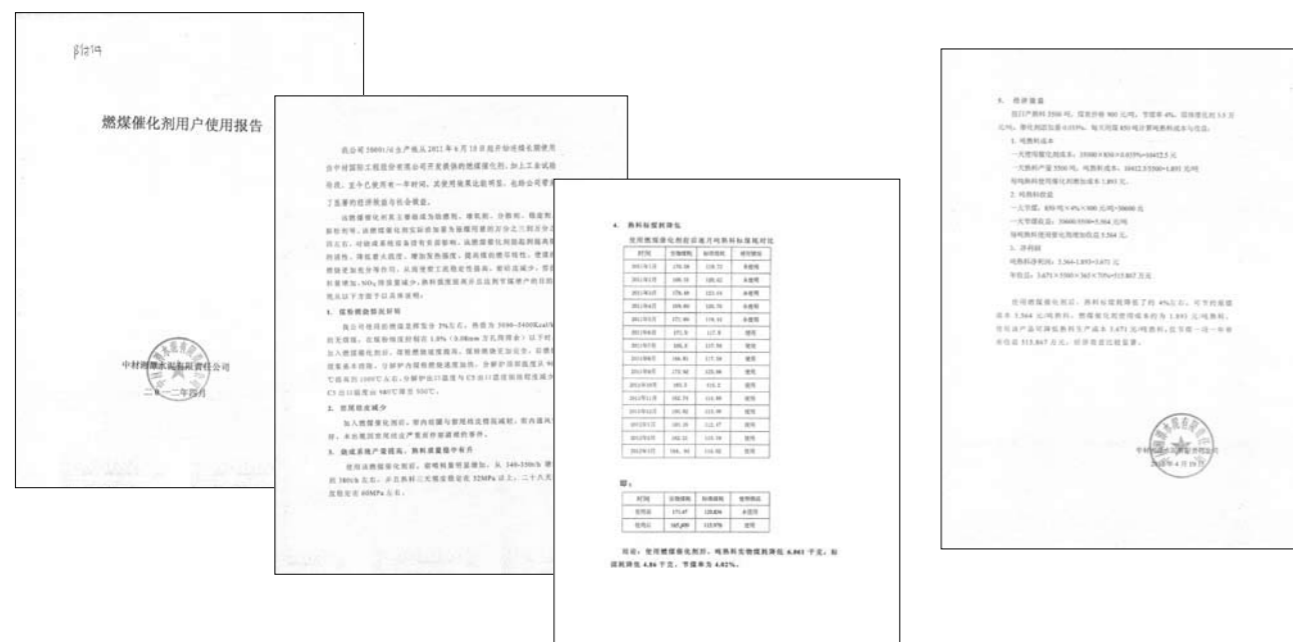
IV. AMOUNT:

The coal combustion catalyst takes 0.01%~0.05% of coal consumption.

The amount of catalyst has a significant impact on catalytic effect. The catalytic effect will be low when the addition is inadequate. However, excessive amount of coal combustion catalyst will cover the charcoal and block air hole, which leads to less combustion effect and increase material cost. So for each type of coal, there will be a best amount of coal combustion catalyst.

V. EFFECT:

The addition of coal combustion catalyst will improve the coal burnout ratio, stable kiln operation, reduce coating, increase kiln feed, reduce NOx emission and coal consumption, and improve clinker strength. This product is non-corrosive and toxic free and will not create any negative impact to burning system and coal mill.



燃煤催化剂应用业绩表

家	生产线规模	使用时间	用煤情况	使用前存在问题	使用催化剂后效果	节煤率/%	提产率/%
中材湘潭水泥有限责任公司	5000t/d	2011.5-2012.4	无烟煤 A:32-36%; V:2.5-3.5%; Q:4900-5300kcal/kg	窑尾温度高, 结皮严重; 分解炉煤粉燃烧不完全, 后燃烧现象较严重; 产量低, 煤耗高	1. 煤粉燃烧速度提高, 煤粉燃烧更加完全, 窑电流平稳, 窑工况稳定性提高; 2. 分解炉内煤粉燃烧速度加快, 燃尽时间缩短, 燃尽率提高。分解炉出口温度与C5出口温度倒挂程度减少40%; 3. NOx排放量由原来的平均890 mg/Nm <sup>3</sup> 减少到720mg/Nm <sup>3</sup> , 减少了19.1%; 4. 熟料平均强度提高3.3%, 游离钙合格率提升15%。	5.7	5.1
四川自贡金龙水泥有限公司	3200t/d	2011.6	混煤 A:20-25%; V:7-10%; Q:4900-5300kcal/kg	煤中硫含量较高; 飞砂料情况严重, 整体窑工况差	1. 燃烧器喷煤管“戴帽子”现象减少; 2. 飞砂料减少; 3. 整体窑工况得到改善。	7.2	3.3
中材株洲水泥有限责任公司	5000t/d	2011.12	混煤 A:25-30%; V:10-16%; Q:5100-5500kcal/kg	厚窑皮严重; 存在一定的温度倒挂现象; 煤耗较高	1. 窑结皮减少, 窑皮平整; 2. 窑头燃烧器端面结焦现象减少; 3. C5下料温度与分解炉出口温度倒挂现象减轻; 4. 窑系统稳定性明显改善。	3.2	3
罗江利森水泥有限公司	2500t/d	2012.3	烟煤 A:19-23%; V:20-24%; Q:5800-6100kcal/kg	掺烧电石渣, 生料配比硅率较高, 较为难烧; 燃烧器性能差	1. 窑工况稳定, 窑结皮减少; 2. 电石渣掺量增加; 3. 节煤效果明显, 经济效益显著。	4.3	/
涿州亿力达热电有限公司	12MW	2012.1	烟煤 A:28-32%; V:24-27%; Q:4300-4700kcal/kg	煤质波动大, 煤水分离, 煤耗高	1. 节煤效果明显, 节煤率为5.11%; 2. 燃煤催化剂在试用过程中没有出现安全隐患, 对脱硫设备、锅炉等设备产生负面影响, 同时燃煤催化剂添加方便, 流量易于控制; 3. 燃煤催化剂成本低, 节煤效果好, 经济效益显著。	5.1	/

PERFORMANCE OF COAL COMBUSITON CATALYST

OWNER	CAPACITY	DATE OF USE	Kind of COAL	PROBLEMS	SITUATION AFTER USING COAL COMBUSTION CATALYST	COAL SAVING/%	CAPACITY INCREASED /%
Sinoma Xiangtan Cement Co. Ltd	5000t/d	2011.5-2012.4	anthracite A:32-36%; V:2.5-3.5%; Q:4900-5300kcal/kg	High preheater outlet temperature, severe coating, insufficient combustion of calciner, severe secondary combustion, low capacity high coal consumption	1. increase coal combustion speed, more sufficient combustion, stable kiln current and kiln operation; 2. increase coal combustion speed and improve burnout ratio of calciner, reduce 40% of calciner outlet temperature and C5 outlet temperature reversible; 3. reduce NOx from 890 mg/Nm <sup>3</sup> average to 720 mg/Nm <sup>3</sup> , 19.1% less; 4. increase average clinker strength 3.3%, increase 15% of qualified free CaO	5.7	5.1
Sichuan Zigong Jinlong Cement Co. Ltd	3200t/d	2011.6	Mixed coal A:20-25%; V:7-10%; Q:4900-5300kcal/kg	High sulfur in coal, much powdery clinker, bad kiln condition	1. reduce coking of burner tip; 2. reduce powdery clinker; 3. improve kiln operation	7.2	3.3
Sinoma Zhuzhou Cement Co. Ltd	5000t/d	2011.12	Mixed coal A:25-30%; V:10-16%; Q:5100-5500kcal/kg	Thick coating, high coal consumption, a certain temperature position reversible condition	1. reduce coating and enable coating flat; 2. reduce coking of burner tip; 3. reduce calciner outlet temperature and C5 outlet temperature reversible; 4. improve kiln operation	3.2	3
Luojiang Liseng Cement Co. Ltd	2500t/d	2012.3	Bituminous coal A:19-23%; V:20-24%; Q:5800-6100kcal/kg	Adding calcium carbide residue, high SM hard to burn, bad performance of burner	1. reduce coating and stable kiln operation; 2. add more calcium carbide residue; 3. apparent coal saving and extraordinary economic effect	4.3	/
Zhuozhou Yilida Thermal Power Co., Ltd	12MW	2012.1	Bituminous coal A:28-32%; V:24-27%; Q:4300-4700kcal/kg	Much variation on coal, high moisture of coal, high coal consumption	1. apparent coal saving and reached 5.11 %; 2. no potential danger when trial using coal combustion catalyst, no negative impact to desulfurization equipment and boiler, easy operation to add coal combustion catalyst and easy control of flow; 3. low cost of coal combustion catalyst, apparent coal saving and extraordinary economic effect	5.1	/

## (6) 使用方法

将催化剂加入一定比例的水稀释后均匀喷洒在入煤磨之前的皮带上，使煤和催化剂均匀混合。

## (7) 作用原理

1、使煤燃烧所需的活化能减小，增大煤的活性，使着火点降低，煤更易燃烧。

2、助燃剂使煤粉的燃烧速度加快，提高分解炉和窑内温度，加快煤中各种键的断裂，提高煤挥发分的析出速度，燃尽时间缩短，使煤燃烧更加完全，从而提高煤的利用率，节约了能源。

3、催化剂中的金属元素起到氧元素传递和电子转移的载体，使传递速度变快，加快燃烧的反应速度，从而使煤燃烧更完全。

4、由于分散剂的作用使催化和助燃作用不仅在煤粉表面，并且在煤粉内部进行，从而使煤粉着火和燃烧更易进行。

5、膨松剂使煤的内部热压超过外部热压，发生裂变，使炉膛的燃煤自燃蓬松，而增加供氧面，使煤完全燃烧，不易结焦，同时使空气易流通，促进了氧气和碳的充分燃烧。

6、在燃烧过程中，NO的形成基本在高温区，温度脉动越大，峰值温度越高，烟气中NO的浓度越大。加入催化剂后，一方面加强燃烧稳定性，避免了窑内高温温度脉动，减少了窑内NO的形成量。另一方面，加入催化剂后，由于燃烧速度加快，用吸附态氧和晶格氧对C进行氧化，减少了燃料N向NOx的转化。

7、催化剂中含有的微量元素，一方面降低生料烧成熔点，使液相提前出现，大大降低熟料形成活化能，加快了熟料矿物的反应速度，使熟料中C<sub>3</sub>S在低温下快速大量形成，另一方面由于微量元素的晶体诱导作用，促进熟料中

新生C<sub>3</sub>S的高活化性，从而降低水泥熟料的烧成热耗并提高熟料的强度。

## (8) 技术特点

本技术提出的燃煤催化剂以微量加入煤中，在节煤降耗的同时又能降低劣质煤向空气中排放二氧化硫和氮氧化物等空气污染物，同时对水泥熟料的烧成没有任何负面影响，对解决水泥工业能源危机具有重要的现实意义。

本技术还具有如下特点：

1、煤种适应性好，可适应于多种新型干法水泥窑用煤，对质量较差的劣质煤也能起到较好的燃烧效果。

2、本技术适用于各种窑炉特别是新型干法水泥窑，所含的微量元素能降低熟料烧成熔点，使液相提前出现，同时降低水泥熟料的烧成热耗并提高熟料的强度。

3、起到节煤和减少污染物排放的综合作用，节煤4~10%，氮氧化物减少10%以上。

4、针对水泥厂不同工艺、不同的煤种有不同的配方；

5、并且在使用过程中根据水泥厂需求还在调节配方；

6、可针对水泥厂原、燃料特点进行各种检测分析。

## (9) 经济效益

1、节煤直接经济效益计算公式：

节煤效益=年耗煤量×煤炭价格×节煤率-年耗煤量×催化剂添加比例×催化剂价格

2、其他直接经济效益

包括产量提升带来的利润增加、NOx排放量减少带来的环保费用节省等。

据测算5000t/d的生产线，使用催化剂，单节煤一项，一年可为企业节约成本700万元，若算上增产等带来的利润增加，每年可为企业带来效益超过1000万元。

## VI. USAGE:

Coal combustion catalyst will mix with a certain percentage of water and homogenous spray on belt conveyor to coal mill.

## VII. WORK PRINCIPLE:

1. to reduce the activation energy of coal combustion required, increase activity of coal, reduce ignition point and enable the combustion of coal easy;

2. combustion improver helps acceleration of coal combustion, increases calciner and kiln temperature, accelerates breaking of coal bonds, improves exhalation rate of volatile of coal, shorten burnout time, enables more sufficient combustion of coal, so as to improve the utilization of coal and save coal consumption;

3. metal in catalyst works as carrier of oxygen transmission and electron transfer, which accelerates transfer speed and combustion reaction speed so as to make coal combustion more sufficient;

4. function of dispersant enables catalysis and combustion aid to be done at the surface and internal of pulverized coal, and resulting in easier ignition and combustion of pulverized coal;

5. leavening agent results coal internal thermal pressure exceeds external ones and creates fission, so that coal will be naturally in bulk and have more oxygen supply surface. It enables sufficient combustion of coal, not easy to coking. In the meanwhile, it enables air ventilation smooth and promotes sufficient combustion of oxygen and carbon;

6. NO generally forms at high temperature zone during combustion. The more temperature fluctuation it has, the summit temperature it will be. And NO content will be more. After adding catalyst, it will on the one hand enhance the stability of combustion and avoid temperature fluctuation in kiln and reduce the formation of NO. On the other hand, due to acceleration of combustion speed, oxygen in adsorption state and Lattice oxygen will oxidize C and reduce the transformation to NOx;

7. trace element of catalyst will on the one hand reduce the melting point of raw meal and make liquid phase to be presented in advance. It greatly reduces activation energy of clinker formation and speeds up reaction speed of clinker minerals, and enables large amount of C<sub>3</sub>S formed under low temperature. On the other hand, owing to crystal inducing

function, it promotes high activation of newly formed C<sub>3</sub>S and reduces the heat consumption of clinker and improves the strength of clinker.

## VIII. CHARACERSITCS:

Coal combustion catalyst technology is to add minor catalyst to coal and try to reach the target of coal saving and reduction of pollutant emission including SO<sub>2</sub> and NOx, and also not creating any negative impact to clinker burning system. It plays very important role in resolve the energy crisis to cement industry.

Besides, such technology has the following advantages:

1. to have wide adaptability to all types of coal, appropriate for multi-types of new dry process cement production and have better combustion effect to inferior coal;

2. appropriate for different types of process, especially for new dry process cement kiln, contained trace element can reduce clinker melting point and make liquid phase to be presented in advance. Besides, it reduces the heat consumption of clinker and improves the strength of clinker.

3. to play comprehensive function of coal consumption saving and pollutant emission reduction, coal saving 4~10%, NOx emission reduced over 10%

4. different formula regarding different process and types of coal;

5. to be adjusted according to requirement of clinet;

6. to perform inspection and analysis according to raw material and fuel condition;

## IX. ECONOMIC EFFECT

1. Direct Economic Benefit of Coal saving

Coal saving Benefit=annual coal consumption × coal price × coal saving ratio-annual coal consumption× percentage of coal combustion catalyst xcoal combustion catalyst price

2. Other Direct Economic Benefit

Including profit increased owing to more capacity, reduction of environmental protection fee due to less NOx emission

It is estimated if using coal combustion catalyst in a cement production line (5000t/d), it will save RMB 7million operational cost because of coal saving. Considering profit increased owing to more capacity, it will bring annually RMB 10million benefit to cementproducers.



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