

# 六级预热器系统

## 6 STAGE PREHEATER SYSTEM



### 主要技术优势

#### Main technical advantage

- 可适应700~12000t/d的窑系统生产规模
- 预热器系统换热效率高、阻力损失低
- 分解炉能适应低热值煤及替代燃料等多种燃料
- 入窑生料分解率稳定
- NO<sub>x</sub>排放浓度低
- Available for cement production line with capacity of 700~12000 t/d clinker;
- High heat exchange rate and low pressure loss;
- Adaptable for low calorific value coal and alternative fuel;
- Stable decomposition rate of kiln feed;
- Low NO<sub>x</sub> emission

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## 1 概述

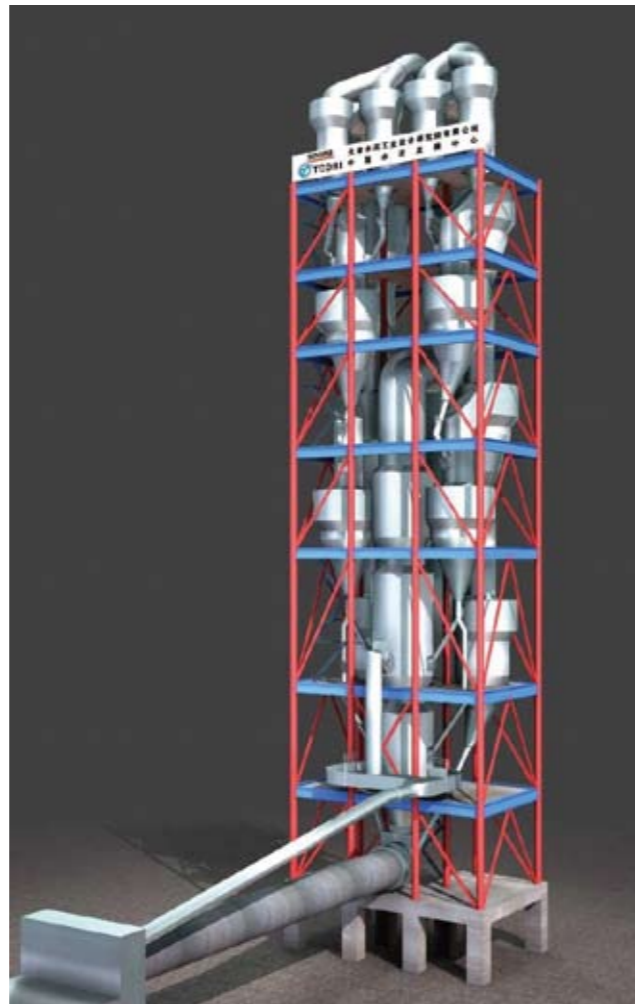
### General

预热预分解技术是预分解烧成工艺的核心技术。我公司目前已经提供了五百台套以上窑尾预热器系统，确保了在新型干法水泥生产技术领域处于国内外领先地位。

窑尾预热器系统的作用是对生料进行预热，并使大部分碳酸盐分解，出分解炉生料经最下级预热器分离后入窑煅烧。因此预分解系统的级数及性能对烧成系统热耗和预热器系统出口压力有很大影响。当原料综合水分较低时，国外水泥企业普遍倾向于采用六级预热器系统以降低烧成系统热耗。六级预热器系统适合于原料水分不是很高的工程，尤其对能源短缺和水资源短缺的地区是很好的选择。

Precalcining technology is the core technology of clinker burning system. Up to now, we have provided over 500 sets of preheater system, so as to ensure our technology in leading position of Chinese and International market.

The function of preheater system is to preheat the raw meal and to decompose most of carbonate. Raw meal after calciner will be burnt in kiln. By such reason, the stages of precalcining system and its performance plays a very important impact to heat consumption of burning system and outlet pressure of preheater system. When integrated moisture of raw material is lower, the foreign cement producers prefer to use 6-stage preheater in order to minimize the heat consumption of burning system. 6-stage preheater is suitable for raw material with moderate moisture, especially for the region lack of energy and water resources.

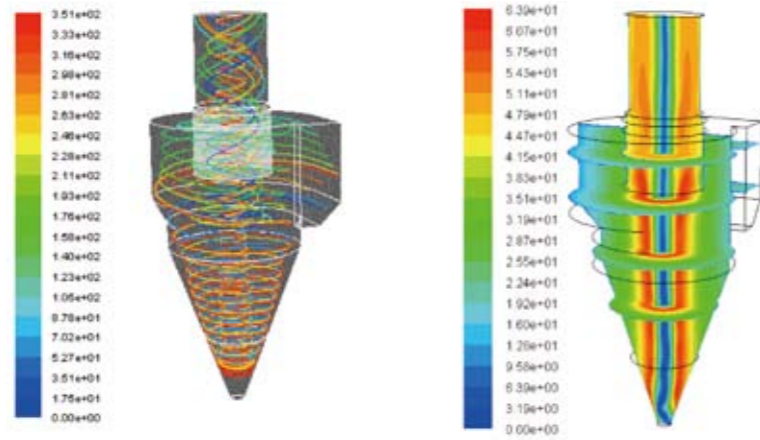


## 2 技术特点

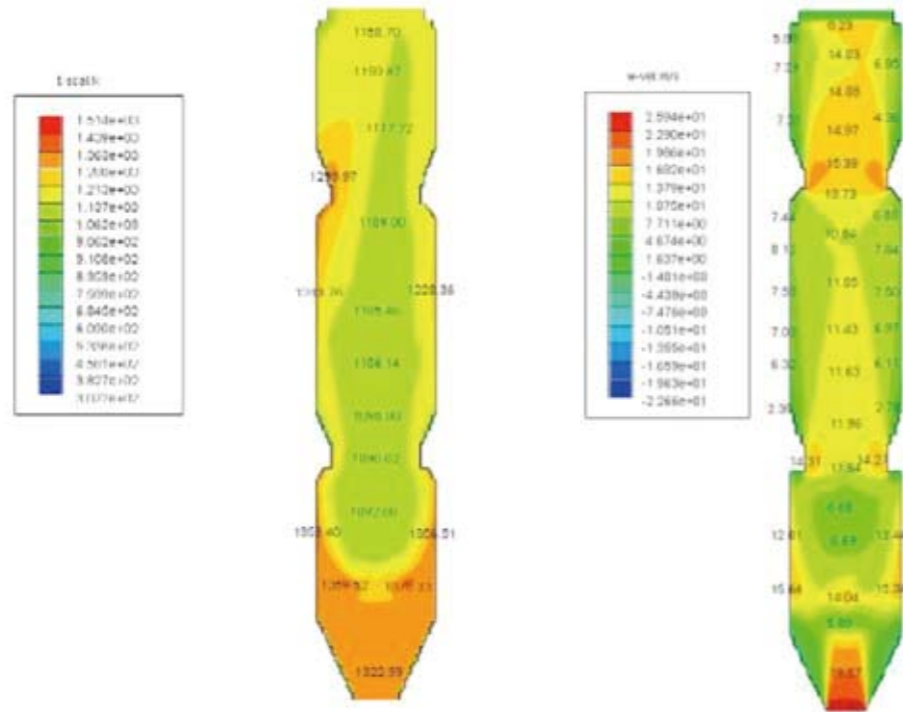
### Technical characteristics

我公司借助于现代流体力学、燃料燃烧学和气固两相流原理，通过对分解炉和旋风筒单体设备原理分析，提出对单体设备结构的构想，在此基础上进行了大量的冷热态试验研究及计算机仿真，开发出结构简单、适应于不同原燃料的三喷腾型TTF高效分解炉和结构简单的大蜗壳旋风筒、悬挂分片式的耐热钢内筒、滚动轴承结构的锁风阀和箱式结构的撒料盒等新型结构预热器系统，大大提升了预热器系统的换热效果和对燃料的适应性，同时大幅度降低了预热器压损。我公司六级预热器系统采用高效低压损的旋风筒，可有效降低预热器系统出口温度和阻力，同时分解炉采取分级燃烧技术，NO<sub>x</sub>排放浓度降低明显，整个窑尾系统结构布置紧凑，有效的降低了窑尾框架高度和大小，有利于节省投资。主要技术经济指标为：系统产量：700~10000t/d熟料；C1出口温度：≤280℃。

Depending on modern Fluid mechanics, fuel combustion and gas-solid two-phase flow theory, based on analysis to calciner and cyclone, we made a great deal of hot and cold model test research and simulation, and developed new preheater system including TTF high efficiency calciner of simple structure and adaptable for different raw material & fuel, volute casing cyclone, suspended segmented heat resistant steel dip tube, air lock valve of rolling bearing and spreading case. It greatly improve the heat exchange effect of preheater system and adaptability to fuel, and also greatly reduce the pressure loss of preheater. Such preheater system uses high efficiency low pressure loss cyclone, so as to effectively reduce the outlet temperature and resistance of preheater outlet. Besides, stage combustion technology is used to minimize the NO<sub>x</sub> emission. The whole preheater system is arranged compact and minimize the size of tower frame and good for investment saving. The main technical parameters includes capacity covering 700~10000t/d clinker and C1 outlet temperature ≤280℃.



气体在旋风筒内的运动轨迹及速度分布  
Gas motion & velocity distribution in cyclone



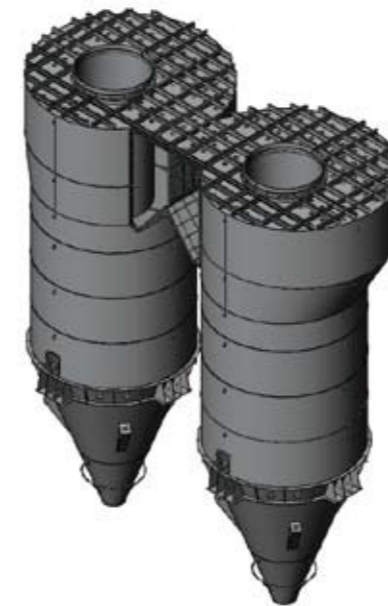
TF分解炉温度及速度分布  
Temperature and velocity distribution of ttf calciner

### 1、旋风筒

- 旋风筒进口采用270°两心大蜗壳结构，通过优化的结构型式，降低旋风筒压损，并提高旋风筒分离效率，最上级旋风筒分离效率达到95%以上；
- 除C1旋风筒外，其他级内筒采用耐热钢分片式结构，便于安装和检修更换；
- 下料管道上采用翻板阀进行锁风，翻板阀活动灵活，锁风效果好；
- 为吸收热膨胀，旋风筒顶盖采用预拉处理，结构布置上充分采取径向和轴向热补偿措施，各级料管设置独立的膨胀节；
- 采用固定式撒料装置，确保生料在管道中均匀分散，提高管道换热效果；
- 根据预热器系统布置，旋风筒可采取歪锥结构，可有效降低塔架高度，同时有效防止锥部积料堵塞。

### Cyclone

- In applying twin-core volute casing with 270° inner helix, the dimension and shape of gas inlet is reasonably designed to minimize or prevent from inlet gas against over flow; and increase separation efficiency of top cyclone over 95%;
- Heat resistant steel plate segment is used as the dip tube of other cyclone except of C1, and easy for installation, maintenance and replacement;
- To use flexible flap valve in feeding chute for air lock;
- In order to absorb heat expansion, pre-stretch processing is made for cyclone top plate. Radial and axial heat compensation measures are applied in structure arrangement. Separate expansion joint is equipped for material duct of each stage.
- To use fixed spread device to ensure the uniform distributed raw meal inside duct and improve the heat exchange effect.
- According to arrangement of preheater system, the cyclone can use spirality cone structure, so as to substantially reduce height of preheater tower and effectively prevent from blockage at cone part.



C1旋风筒  
C1 Cyclone



中间级旋风筒  
Intermediate Cyclone



## 2、分解炉

● TTF炉具有三喷腾和碰顶效应、固气停留时间比大 ( $\tau m=4\sim 5$ )、湍流回流作用强、温度场及浓度场均匀、物料分散及换热效果好、炉体结构简单、阻力系数低；相对于管道型分解炉而言，三钵型式的分解炉在相同容积情况下其设备重量较轻，同时分解炉的容积效率较管道式分解炉高，避免了长管道导致的层流现象；

● 喂料方式合理，调节灵活。采用上下料点合理分料，创造燃烧区中部局部高温区，分解炉局部温度可达 $\sim 1300^{\circ}\text{C}$ ，可大幅提高煤粉燃烧效果，高温区间设计 $\sim 1.5\text{s}$ ，可保证劣质煤及无烟煤的充分燃烧；C5下料点位于三次风正上方，可充分分散，分解炉物料分布均匀，流场更合理，同时可减少锥部塌料，分解炉的压损可大幅减少，系统相应阻力降低；

● 喂煤方式：二通道对称四点喷入，优化分解炉温度场，消除窑尾喷煤管磨损；

● 可操作性和适应性强。TTF炉操作简单，对燃原料适应强。

● 采用空气分级和/或燃料分级技术，NO<sub>x</sub>排放可减少30%左右。

## Calciner

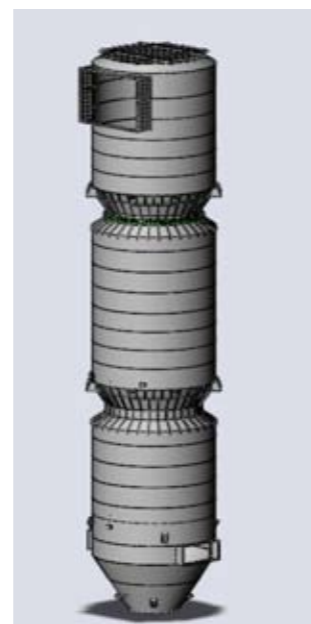
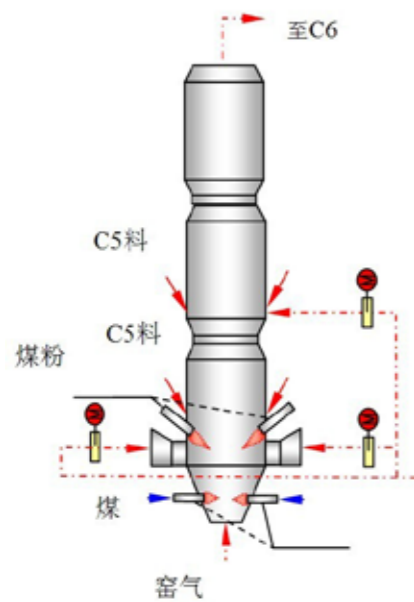
● TTF calciner is of the effect of triple spouting and top-touching, and characterized of strong function of turbulent flow and reflow, big solid and gas retention ratio ( $\tau m=4\sim 5$ ), even temperature field and concentration field, good material scattering and heat exchange, simple structure and low resistance factor. Comparing with ducting calciner, triple sagger calciner, under same volume, is of less equipment weight, and of higher volumetric efficiency, avoiding layer phenomenon owing to long duct.

● Way of Feeding: reasonable distribution of upper & lower feeding inlet, the local temperature of middle of calciner reaches  $1300^{\circ}\text{C}$  and can largely improve the combustion effect of pulverized coal. The retention time at high temperature zone is designed at about 1.5s, in ensuring sufficient combustion of bad coal and anthracite. The material is arranged right above tertiary air and can be scattered completely. Such arrangement ensures even material distribution of material in calciner and reasonable flow field, as well as to minimize cone part material collapse, greatly reduce the pressure loss of calciner and reduce the system resistance accordingly.

● Way of Coal Feed: 2-Channel 4-Point Symmetrical Injection, temperature field optimum.

● Operatability Simple operation and wide adaptable to raw material and fuel

● To use staged air and/or fuel classification, so as to reduce 30% NO<sub>x</sub> emission



## 3 应用实例

### Applicable expample

我公司六级预热器系统在陕西社会水泥有限责任公司5000t/d生产线上得到应用，使用效果良好。

The 6-degree preheater system has been successfully applied in cement production line (5000t/d) of Shaanxi Society Cement Co., Ltd. and it acts good effect.



沁阳金隅2500t/d湿排电石渣生产线  
QinYang Jinyu 2500 t/d wet-discharged carbide slag production line



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