

# Air distribution ratio of waste heat power generation grate cooler

Does grate cooler affect clinker cooling and waste heat recovery?

As an important process during the cement production, grate cooler plays significance roles on clinker cooling and waste heat recovery. In this paper, we measured experimentally the heat balance of the grate cooler, which provided initial operating parameters for optimization.

What are the structural parameters of a grate cooler system?

In this grate cooler system, the inlet temperature of each air chamber is set to 303 K, and the inlet temperature of clinker is 1673 K. The structural parameters of each fan are shown in Table 1. The mass flow rate of clinker is  $72.22 \text{ kg}\cdot\text{s}^{-1}$ . The specific heat capacity of clinker is  $920 \text{ J}\cdot\text{kg}^{-1}\cdot\text{K}^{-1}$ .

Is grate cooler a series-connected heat exchanger network?

In this paper, we measured experimentally and calculated the heat balance of the grate cooler system from the cement plant of  $5000 \text{ t}\cdot\text{d}^{-1}$  productive capability, which provided initial operating parameters for optimization. Then, the grate cooler system was simplified into a series-connected heat exchanger network.

How is a grate cooler system simplified?

Then, the grate cooler system was simplified into a series-connected heat exchanger network. Based on the power flow model, the equivalent thermal resistance network model and the global constraints were constructed by combining Kirchhoff's law.

Does a grate cooler improve heat recovery efficiency?

The results showed that the total mass flow rate of the optimized scheme had little change compared with the original scheme, while the fan power consumption was reduced by about 25.44% and the heat recovery efficiency of grate cooler was improved by 11.35%. The effects of local heat load distribution and clinker diameters were then discussed.

Why is Moga used in grate cooler system?

In the grate cooler system, the entropy generations caused by heat transfer and viscous dissipation have opposite changes with the air flow rate, because the increase of air flow rate will result in the decrease of air outlet temperature and the increase of pressure drop in clinker layer. Therefore the MOGA is adopted.

cooled and waste heat is vented into the atmosphere) and during the cooling of clinker product at the air quenching coolers (AQC) stage. In the dry process cement plants nearly 40 percent of the total heat input is rejected as waste heat from exit gases of preheater and grate cooler.

The paper discussed a multi-objective optimization model of the cooling air distribution of a grate cooler according to the analogy of a cross-flow heat exchanger and entropy-generation ...

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Increasing the power-to-heat ratio of the district heating systems in the EU in general from the current average of 0.45 to 1.0 can lead to an increase in CHP electricity generation of around 310 TWh. This equates to a CO<sub>2</sub> reduction of 106.4 Mt, taking into account the electricity generation mix as given by the European Network of Transmission System Operators for Electricity ...

In this study, we analyze the heat distribution in the entire grate cooler system of a 5000 t/d cement plant through experiments, and acquire the mass flow rates, inlet temperatures, and outlet temperatures of the cooling air and clinker. ... indicates that inducing the exhaust air to the first grate plate is more effective for recovering the ...

The cooling air passes through the material layer of high-temperature materials, completes heat exchange with high-temperature materials, and brings out the heat for pulverized coal, raw material drying or waste heat power generation, so as to achieve the purpose of cooling materials.

The cement industry is one of the energy intensive industries. China's cement industry is the second largest energy consumer and CO<sub>2</sub> emitter (after the iron and steel industry), accounting for 7% of total Chinese energy use and 15% total CO<sub>2</sub> emissions [1]. According to relevant researches, cement industry still has large researching potential on ...

There have been many experimental and numerical studies on the grate cooler system. Madloul et al. [15], [16] reviewed the energy consumption and energy utilization types for different sections of the cement industry, exergy analysis, and exergy balance of the cement industry. Ahamed et al. [17] established a mathematical model for the energy, exergy, and ...

The paper proposes a multi-objective optimization model of cooling air distributions of grate cooler in cement plant based on convective heat transfer principle and entropy generation minimization ...

Also, the thermal efficiency of the pyro-processing unit was 50% that is in the range of modern plants thermal efficiency (50-54%). Secondly, according to the obtained data, the potential of electrical energy production from the exhaust gases of preheater and grate cooler was evaluated through the waste heat recovery power generation (WHRPG ...

Shao et al. (2016) proposed an air distribution model using multiobjective optimization techniques developed to address the issue of heat recovery in a cement grate clinker cooler. Okoji et al ...

A multi-objective optimization model of cooling air distributions of grate cooler in cement plant based on entropy generation minimization analysis is proposed in the paper. The ...

New technologies from FLSmidth are helping to maximise waste heat recovery for today's cement producers -

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without compromising recuperation efficiency. As cement producers are continually looking to improve the performance of their existing assets, many are seeing the upsides of bringing waste heat recovery into the production process. In particular, ...

Energy, 2012. Grate coolers are widely used in cement industries to recover heat from hot clinker, coming out from the rotary kiln. This study focuses on improving the energy, exergy and recovery efficiencies of a grate cooling system through the optimization of its operational parameters such as masses of cooling air and clinker, cooling air temperature, and grate speed.

In some cases, it warms up air to generate waste heat power. The cooler crushes the clinker. It quenches the clinker to an appropriate (low) temperature so that it can be ground into cement and readied for transport. The Clinker Cooler at Work. As the hot clinker is ejected from the rotary kiln, it falls onto the grate bed.

The cooling air flows through the moving clinker vertically as shown in Fig. 1. Energy consumption of fans accounts for 16% of total motors energy consumption of cement production [7]. And the performance of cooling air system affects the energy consumption of cooling fans and heat efficiency of grate cooler greatly.

Compared with actual operating scheme, the total air volumes of optimized schemes decrease 2.4%, total power consumption of cooling fans decreases 61.1% and the outlet temperature of ...

cooling and waste heat recovery. In this paper, we measured experimentally the heat balance of the grate cooler, which provided initial operating parameters for optimization. Then, the grate cooler was simplified into a series-connected heat exchanger network by power flow method. Constructing the equivalent thermal resistance

The grate type cooler is the most suitable cooler for pre-calciner kiln and for kilns with a high outputs; Nowadays grate cooler are designed for large kiln capacities up to 10000 t/d. It's based on cross-current cooling air. The grate coolers can be divided into two main types:-Traveling grate cooler; Reciprocating grate cooler

Grate firing is one of the main technologies that are currently used in biomass combustion for heat and power production. Grate-fired boilers can fire a wide range of fuels of varying moisture content and show great potential in biomass combustion [2], [3], [4]. Though grate firing of biomass has been tried and tested over many years, there are still some ...

an energy process [11]. It is considered that the flow of heat dissipation losses of the cooler are rejected to the ambient air with the temperature  $T_0$ . The exergy balance in steady state of the open system of clinker cooling (Fig. 2) is:  $\dot{d} \dot{c} \dot{k} \dot{c}_{k,in} a_1 a_1 a_2 \dot{E}_x \dot{m} \dot{e} \dot{m} \dot{e} \dot{m} \dot{e} a_2 ( ) \dot{c} \dot{k} \dot{c}_{k,out} a_s a_s a_{exh} \dot{m} \dot{e} \dot{m} \dot{e} \dot{m} \dot{e}$

conventional grate cooler. Fig 2.3: The Conventional Grate Cooler. Source: (Smidth, 2014) 2.3.2 Air-Beam

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Grate Coolers: These are 2nd generational grate coolers that equally has the ability to handle large capacities but better heat recuperation compared to conventional grate cooler and improved cooling air distribution across the entire cooler.

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A reduction of emissions, implying a conversion of waste heat to more noble forms of energy and a concurrent increase of efficiency of the same devices and processes, is of paramount importance.

DOI: 10.1016/J.APPLTHERMALENG.2016.07.088 Corpus ID: 114409419; Multi-objective optimization design of air distribution of grate cooler by entropy generation minimization and genetic algorithm

The paper discussed a multi-objective optimization model of the cooling air distribution of a grate cooler according to the analogy of a cross-flow heat exchanger and entropy-generation minimization analysis. The modified entropy generation numbers caused by heat transfer and flowing resistance are regarded as objective functions, and are simultaneously ...

Abstract: The basic situation and structure of the 3rd generation TC grate cooler and the 4th generation Sinowalk grate cooler are introduced. After upgrading to the 4th generation grate cooler, the position of air cannon, grate plate travel, operation mode, coal quality and raw material ratio have been adjusted, so that the performance of the Sinowalk grate ...

A grate cooler is key equipment in quenching clinker and recovering heat in cement production. A two-dimensional numerical model based on a 5000 t/d cement plant is proposed to for a study on the gas-solid coupled heat transfer process between the cooling air and clinker in a grate cooler. In this study, we use the Fluent dynamic mesh technique and ...

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