

Steel Industry **- Design and Construction of Annular Heating** **Furnace Renovation**

An overview of the annular quenching furnace:

The annular quenching furnace is a kind of continuous operational furnaces with the fuel of mixed gas and the burners arranged in a staggered way on the inner and outer ring walls. It is operated at a typical furnace temperature of around 1000-1100 °C in a weak reducing atmosphere under a slightly positive pressure. Before the energy-saving renovation, the lining structure was a refractory brick and heavy castable structure.

This structure has the following problems in its long-term use:

1. The large volume density causes serious deformation on the steel structure of the furnace.
2. The high thermal conductivity of furnace lining leads to poor heat insulation effects and the overheat (up to 150~170°C) on the cold surface of the furnace body, which is a huge waste of energy and deteriorates the operation environment for workers.
3. It is difficult for furnace lining to overcome the inherent defects of the external expansion on the inner wall and the internal expansion on the outer wall of annular furnaces.

4. Poor thermal sensitivity brings a certain negative impact to the microcomputer operation of annular furnaces and also affects product quality to some extent.

The advantages of CCEWOOL ceramic fiber products on annular furnaces:

Small volume density: the weight of the folding module lining is only 20% of the light heat-resistant lining.

Small heat capacity: the heat capacity of ceramic fiber products is only 1/9 of the light heat-resistant lining, reducing the loss of heat conservation of the furnace lining.

Low thermal conductivity: the heat transfer rate of ceramic fiber products is 1/7 of that of the light clay ricks and 1/9 of the light heat-resistant lining, greatly improving the heat preservation and insulation effects of the furnace lining.

Good thermal sensitivity: CCEWOOL ceramic fiber is more suitable for the automatic control of heating furnaces.

The structure of furnace top lining:

It adopts a layered-module composite lining structure with CCEWOOL 1260 ceramic fiber blankets for the back lining and CCEWOOL1430 zirconium-containing ceramic fiber modules for the hot surface. The ceramic fiber modules are arranged like "a battalion of soldiers", and the interlayer compensation blanket uses CCEWOOL1430 zirconium-containing ceramic fiber blanket, fixed by U-shaped heat-resistant steel nails.

The structure of lining on furnace walls:

For walls over 1100 mm, the full-fiber lining structure (except the burner bricks) is adopted. The back lining uses CCEWOOL 1260 ceramic fiber blankets, and the hot surface uses CCEWOOL 1260 ceramic fiber modules which are arranged like “a battalion of soldiers”, anchored in a butterfly shape. The form of the structure is that the outer wall is bigger inside and smaller outside, while the inner wall is the opposite, like a wedge.

The structure of the lining for the inlet and outlet, the flue opening, and the inspection door of the furnace walls:

The CCEWOOL refractory ceramic fiber castable lining is adopted with built-in “Y” shaped heat-resistant steel anchors.

Technical advantages: CCEWOOL refractory ceramic fiber castable is a kind of unshaped refractory ceramic fiber material, which has the characteristics of low thermal conductivity and high compressive strength (of 1.5 after being dried at 110°C), so it can fully realize the functions of the furnace lining at this section.

The structure of the furnace lining for the partition wall between the high- and low- temp zones:

With the composite structure of CCEWOOL ceramic fiber modules and castable, the upper fiber modules are made into super sizes from ceramic fiber blankets and fixed by special anchors on the top of the furnace; thereby forming a fiber retaining wall across the furnace.