Influence of Belt Furnaces on Glass to Metal Sealing
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Application:
Compressor terminals, aviation connectors, battery covers and other metal to glass sealing products.
GTMS Furnace Introduction

Features of Our Furnace:
Combined with the sealing process, special atmosphere control is adopted to maintain a moisture atmosphere with a controllable dew point in the heating zone and high temperature zone, with a controllable cooling-rate method at the end section to meet the requirements of slow cooling of the product.
Problems and Key Technologies in GTMS
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**Problem 1:**
The uncontrolled oxidation of the metal shell affects the sealing effect.

**Major reasons:**
When water vapor and metal react at high temperature, three metal oxides of FeO, Fe3O4 and Fe2O3 are formed. Fe2O3 has a loose structure and low sealing strength with glass. The level of oxidation directly impacts the thickness of Fe2O3 and directly affects the sealing effect.

The level of oxidation to the metal shell will directly impact the sealing effect.
Problems and Key Technologies in GTMS

Basic principles of metal to glass sealing

The reaction between the metal shell and water vapor at high temperature from the inside layer to the outside layer:

- $\text{Fe} + \text{H}_2\text{O}$
- $\frac{3}{4}\text{Fe} + \frac{1}{2}\text{H}_2\text{O} \rightarrow \frac{3}{4}\text{FeO} + \frac{1}{2}\text{H}_2$
- $\frac{2}{3}\text{Fe} + \frac{1}{3}\text{H}_2\text{O} \rightarrow \frac{2}{3}\text{Fe}_3\text{O}_4 + \frac{1}{3}\text{H}_2$

The chemical bond of metal and FeO is similar; therefore, the bond is tight.
The chemical bond of Glass and Fe$_3$O$_4$ is similar; therefore, the bond is tight.
Fe$_2$O$_3$ has a loose structure and insufficient bonding strength with glass.

Controlling the amount of Fe$_2$O$_3$ is controlling the thickness of the oxide layer.
Controlling the dew point in the furnace is controlling the thickness of the oxide layer.
Problems and Key Technologies in GTMS

Dew point feedback loop

- Great Dew point feedback loop, accuracy ±1°C
- The U.S. Dew-point meter, with a probe protective filter, increased stability of dew point detection
Problems and Key Technologies in GTMS

Problem 2: The furnace belt is wide, so the sealing performance of the product is inconsistent.

Major reason: The inlet air at the heating and high temperature zone is the key. The uneven air intake will lead to inconsistent sealing performance of the product.

With a wide furnace, the oxidations at left, middle and right points are inconsistent, resulting in inconsistent product performance.
Problems and Key Technologies in GTMS

How to control ATMO for GTMS

- Stable gas inlet
- Well mix of wet and dry N2
- Evenly gas inlet

Diagram of atmosphere control furnace

ATMO control system

- Inlet air curtain
- Exhaust Assist
- Heat-up gas (N2 + H2O)
- High-temperature gas (N2 + H2O)
- Cool down gas (N2 + H2O)
- Outlet air curtain
- Belt direction
Multi-stage regulated air inlet system can effectively avoid the interference of air source pressure fluctuation.

Well mixed N2

Dry N2

Wet N2

Multi-layer curtain ensures that uniform dew point is stable.

Up to 400mm belt width, products will allow for good oxidation consistency and product performance consistency after sealing.

Special air box layout can ensure the uniformity of air intake.
Question 3: The glass is easy to crack in the following process after the sealing is completed.

Major reason:
After the sealing is completed, the cooling rate is not controlled, so there is a stress on the glass.

After sintering, the glass is easy to crack in the subsequent process.
Problems and Key Technologies in GTMS

Controllable cooling rate technology

Optimize the structural design and extend heat preservation and cooling time, with an air cooling device in the cooling zone. Which can control the cooling rate of the product. Better annealing results and it can remove the internal stress of the product, which prevents cracking in the subsequent process.
Key Indicators

HSA Belt Furnace (GTMS)

Temperature control
- The uniformity of the mesh belt section is ±2 ~ 3°C
- Control accuracy ±1°C
- Temperature 1050°C

Atmosphere control
- Uniform intake and exhaust
- Dew point -50~+30°C
- Oxygen content control at each point ≤10ppm

Drive system
- Transmission accuracy 2%
- The width of the belt is up to 400mm

Cost
- N2 usage ≤18m³/h
- Power ≤100kW
- Water usage ≤1.5m³/h
Thank you for checking us out!

If you are interested in our furnace line or want to save some money on your next furnace project, please also check out website:

https://www.beltfurnaces.com

If you want to talk to someone about your next furnace purchases, please contact:

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