

In the process of multi-function material heating and energy saving method

ZHAO Yu Bo , SUN Bin , ZHAO Xiang Dong , CHEN Zhu Xin

State Grid Liaoning Chaoyang Power Supply Company, Chaoyang, Liaoning, 122000, China

Keywords: heat ; energy saving ; multi-function material ; infrared heating technology

Abstract. Any heat transfer only exists in three ways : heat conduction, convection and radiation. Existing toughened glass process with electric heating wire, heat transfer is given priority to convection. If the infrared heating technology is used for toughening glass production, the way of heat transfer is given priority to radiation. Infrared radiation heater is based on many materials of infrared absorption which will generally transfer heat energy into the infrared radiant energy and if it is used in the process of heating infrared heater, energy saving can be achieved.

Introduction

Any heat transfer only in three ways of heat conduction, convection and radiation.

Heat conduction Heat from the high temperature parts in the object is passed to the lower part of the temperature, or transfer to another object in contact with process known as heat conduction, also called thermal conductivity. Features: the process of heat conduction in the pure, the object does not occur relative displacement between parts, that no matter the macroscopic displacement.

From the micro perspective, gas, liquid and conductive solid and non solid heat conduction mechanism of each are not identical.

Gas: gas molecules collide with each other while doing the irregular thermal motion of the results.

Solid: conductive solid: movement between the free electrons in a crystal lattice; Good electrical conductors have quite a number of free electrons in motion between the lattice, like these free electrons can conduct electricity, they can convert heat from high temperature to low temperature. The conductive solid: the thermal conductivity of conductive body is done by the vibration of the lattice structure.

Liquid: there are two different points of view, similar to a gas and is similar to the conductive solid.

Convection Inside the fluid particle heat transfer process, caused by the relative displacement between convection occurs only in the fluid. Due to cause relative displacement of the particle is different, can be divided into natural convection and forced convection. Natural convection, fluid is static, but due to different temperature, density, internal cause fluid inside up and down movement by convection. Forced convection: fluid in some forced movement under the action of external force convection.

Thermal radiation Radiation is a kind of energy to the electromagnetic wave propagation phenomenon. Objects can emit radiant energy for a variety of reasons, including object because of the cause of the hot issue of radiant energy is called thermal radiation.

Object heat, heat energy into radiant energy, in the form of electromagnetic wave propagation in space, when faced with another object, be absorbed in whole or in part, again into heat energy. Thermal radiation is not only a transfer of energy, and accompanied by the transformation of the form of energy. In addition, the radiant energy can travel through a vacuum, does not require any material medium.

The infrared heating technology

Existing experiments with heating wire heating, heat transfer is given priority to with convection. If the infrared heating technology was applied to production, the way of heat transfer is given priority to with radiation. Through theoretical calculation, the radiation heat transfer is 7.9 times that of the convection heat transfer, apparently in the process of heating using infrared heater can realize energy saving.

Infrared radiation heater is based on many materials of infrared absorption will generally into the infrared radiation energy, the heat radiation directly to the heated object, cause the resonance of object molecules, so as to achieve at a relatively low energy and fast speed heat objects to the requirements of the temperature. Can pass through the atmosphere of the infrared generally divided into three bands: near infrared band 1-2.5 microns; In the infrared wave band 3-5 microns; 8 and 13 micron far infrared band.

Ordinary infrared heater due to radiation wavelength range is too wide, still no significant energy saving effect. In order to improve the thermal efficiency, must make radiation wavelengths of infrared radiation heater and the heated material absorption wavelength range. Therefore, you must look for the effective absorption wavelength of heated material. The absorption of each material has its special features, that is it for a certain Duan Bo high heat absorption than other wavelengths.

The second is to find appropriate infrared radiation heater. Tungsten filament tube can be near infrared radiation, wavelength is not corresponding, therefore not suitable for laboratory use.

Silicon carbide is a long long far infrared radiation heater, not only the wavelength is not corresponding to its thermal efficiency is low, also do not apply. Quartz glass and ceramic infrared heater to infrared radiation, so more applicable.

Quartz glass variety, the structure of the heater is different also, the wavelength of infrared radiation is also different. According to the properties of the toughened glass infrared absorption, selection, research and development to adapt to the variety of quartz glass and optimum structure of the infrared heater, is a very important problem, so as to adjust the wavelength of the infrared radiation of quartz glass heater, to adapt to the infrared absorption properties used in the experiment, so as to achieve the aim of improving thermal efficiency.

Infrared heating characteristics

The characteristics of infrared radiation heating, radiation heat transfer don't need a medium, can be transmitted in the vacuum, the main components of the air in the atmosphere transmission, rarely infrared absorption of oxygen and nitrogen, so heat loss in the process of medium and medium flow rarely.

According to the thermal calculation, the utilization rate of radiation heat transfer in the 700-700 degrees 5.7 7.4 times that of convection heat transfer.

In addition, the infrared radiation heating has the characteristics of the heating is even. In order to better play to the characteristics of the shape of the heater is very important. For electrical measuring instrument test with heat source, the practice proves that the tube heater is good.

Because in most cases, the heat generated in the heater, reflecting surface inevitably turned black, over a period of time, from its radiation heat, on the back of the reflector into absorption.

In addition, the infrared reflective, installed in the heater reflex, focus on the parts, can make the infrared directional radiation, centralized heating, that is the commonly used methods for infrared energy saving.

Conclusion

Infrared radiation heater is based on many materials of infrared absorption, infrared heating, heat transfer is given priority to with radiation. In general radiation heat transfer is convection heat transfer of a few times, apparently in the process of heating using infrared heater can realize energy saving.

References

- [1] Sun Guokai. Power grid relay protection principle Beijing: China power press, 2008
- [2] Zhi-hui Yang electrical operation and management China electric power press, 2005
- [3] the third edition of the thermodynamic statistical physics, Beijing: higher education press, 2003
- [4] shi-ming Yang, wen-quan tao the fourth edition of the heat transfer, Beijing: higher education press, 2006
- [5] Zhang Hongji heat conduction, Beijing: higher education press, 1992