KANTHAL

Can your furnace perform precision testing fastly and with high control accuracy?

CASE STORY · ACCURATE AND FLEXIBLE HEATING FOR MATERIALS TESTING · SUPERTHAL™

KIMAB, corrosion and metals research institute, is situated in central Stockholm in Sweden and serves the Swedish steel industry and other research institutes with information services, technical and manufacturing support, materials and materials processing development, product design and development, consultancy and various material testing services.

THE CHALLENGE

KIMAB utilizes a comprehensive range of modern testing equipment, including different vacuum and atmosphere furnaces as well as a complete atomiser. Towards the end of 1995, KIMAB began to look for a new tube furnace needed for testing powder metal samples and other materials in different furnace atmospheres.

The old furnace they were using was heated by metallic elements and had a maximum operating temperature of 1200°C (2190°F) but was regarded as being generally worn out. Another tube furnace they have at their disposal is heated by silicon carbide elements, which is actually reaching 1500°C (2730°F), but suffers with rather uneven heating and a high element consumption.

For the new furnace a maximum temperature of at least 1550°C (2820°F) was specified, along with the need for rapid heat-up and cooling, easy programming and preferably equipped with a metallic work tube. Their experiences with ceramic tubes were not entirely satisfactory because of their limited lifetime being prone to thermal shock breakage.

The new tube furnace at KIMAB consists of six Superthal half-shells mounted into two hinged cassettes. The metallic tube in Kanthal APM has an outer/inner diameter of 128/117 mm (5/4.6 in).

THE SANDVIK SOLUTION

High demands on better utility

Sandvik, having experience of many different heating systems in their own materials testing facility, were asked to come up with a solution and suggested Superthal™ heating modules and a work tube made from Kanthal APM™ alloy.

Superthal is a family of ready-to-install heating units with Kanthal® Super molybdenum disilicide ($MoSi_2$) heating elements integrated with ceramic fiber. The modules are available as tubes, half-shells or panels in a broad product range. Maximum working temperature is 1500–1600°C (2730–2910°F) depending on design. In this case half-shells were chosen to form an easy to open furnace.

The metallic tube is fabricated from the well known Kanthal APM FeCrAl alloy in a special way which gives the tube outstanding high temperature oxidation and form stability properties. The tube can be used up to 1250°C (2280°F). Outside the heating chamber, the tube is water cooled and at the ends there are welded inlets for introducing different gases and vacuum. The heating elements are series connected directly to the line voltage, hence no transformer is needed. The power is regulated automatically by a thyristor controller.

THE RESULT

Superthal™ and tubes in Kanthal APM™ – an ideal combination

The new furnace is easy to regulate, quick to temperature and allows very accurate testing operations to be performed. The maximum temperature of 1550°C (2820°F) is reached in less than 30 minutes. Up to 60 samples placed on aluminum oxide vessels inside the tube, are now tested at the same time, compared to the methods used before when encapsulation of the samples in glass was necessary to control the atmosphere. Today the tube is "washed" by vacuum and argon before introducing the controlled atmosphere of nitrogen, hydrogen or a mixture of both. Precision testing operations can now be performed much faster and with a considerable improvement in control accuracy.

The temperature uniformity is about +/- 3°C (+/- 5.4°F) in the mid 200 mm (7.9 in) section of the furnace. The samples can easily be handled when inside the tube and can, for instance, be moved to a cooler part after completion of the heating cycle. No problems are encountered with the metallic tube in terms of thermal shock. So far, KIMAB has operated the furnace up to 1250°C (2280°F), but they are also prepared for using it at higher temperatures together with a ceramic work tube.

The furnace is equipped with a multi-gas feed system that includes vacuum and various protective gases. The tube is water-cooled outside the heating chamber.

Superthal heating modules are available as tubes, half-shells and panels in a broad standard range for temperatures up to 1600°C (2910°F).

Sandvik Group
The Sandvik Group is a global high technology enterprise with 47,000 employees in 130 countries. Sandvik's operations are concentrated on three core businesses: Sandvik Tooling, Sandvik Mining and Construction and Sandvik Materials Technology – areas in which the group holds leading global positions in selected niches.

Sandvik Materials Technology
Sandvik Materials Technology is a world-leading manufacturer of high value-added products in advanced stainless steels and special alloys, and of medical implants, steel belt-based systems and industrial heating solutions.

CHALLENGE
YOUR EXPECTATIONS

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