KANTHAL

KANTHAL APMT™ Tube

An Exciting New Development in the Field of High Temperature Metallic Alloy Tubes

KANTHAL APMT offers design engineers the possibility to use alumina forming alloy tubes in applications that were previously accepted to be the domain of ceramic materials, or where performance has been limited by the capabilities of conventional nickel based alloys.

Whether you are a furnace builder, burner manufacturer, or a user of a furnace suffering from performance limitations, or requiring heavy and regular maintenance, KANTHAL APMT tube just may be the problem solver you have been waiting for.

Compared with conventional chromia forming NiCr and FeNiCr based alloys, KANTHAL APMT offers:

- Higher Productivity
- Faster heating response
- Faster furnace throughput
- Shorter Cycle times
- Higher Process Temperature Capability
- Longer Life
- Cleaner operation
- Maintenance free operation

Based on KANTHAL APM technology, KANTHAL APMT has been formulated with dispersoids and alloying

elements to provide a much higher mechanical strength compared with KANTHAL APM and conventional FeNiCr/NiCr alloys.

Having a FeCrAlMo composition, this new, highly homogenous, oxide dispersion strengthened alumina forming PM alloy, now offers all the benefits of the well proven KANTHAL APM material, but much stronger, even stronger than NiCr/FeNiCr alloys.

KANTHAL APMT Cures Sagging Problems

KANTHAL APMT remains straight and rigid at operating temperatures, thus curing sagging and bending problems commonly associated with conventional metallic tube materials.

KANTHAL APMT tubes do not need to be rotated after a period in operation to counter creep deformation and sagging.

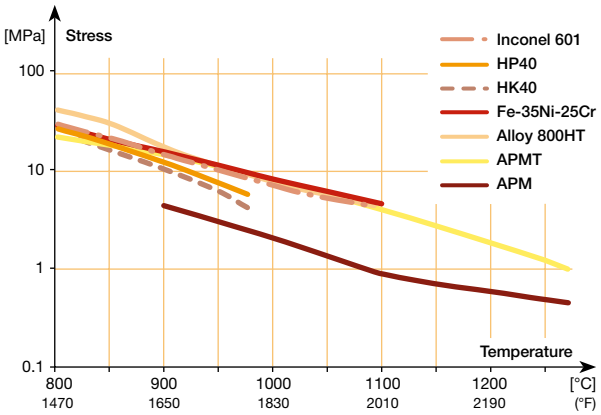

Figure 1 Creep rupture strength – 10 000 h.

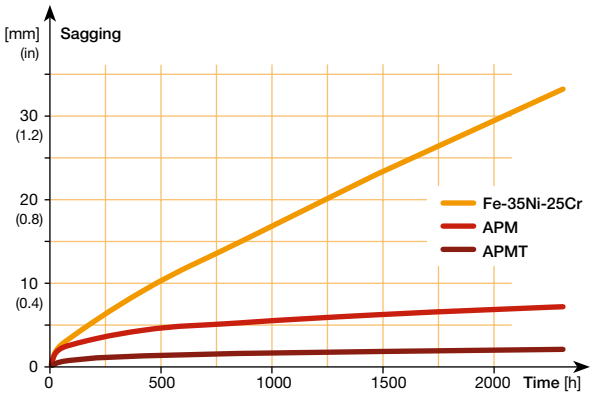

Figure 2 Comparative sagging test at 1100°C (2010°F).

APMT Superior Oxidation Properties

Alumina forming alloys have long been known to possess superior resistance to oxidation as compared to conventional chromia forming NiCr, and FeNiCr based alloys.

KANTHAL APMT forms a thin, dense and highly adherent protective oxide scale of thermodynamically stable alumina.

In this respect KANTHAL APM set the benchmark for FeCrAl alloy types, therefore the oxidation resistance level of KANTHAL APM was used as the goal during the development of KANTHAL APMT. As can be seen in Figure 3b, the superb oxidation properties of KANTHAL APM have been maintained in KANTHAL APMT. Figure 3a shows the alumina oxide layer of KANTHAL APMT compared to Fe-35Ni-25Cr.

Figure 3a

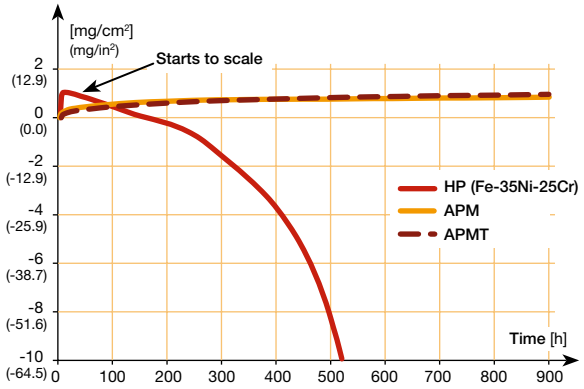

Figure 3b Sample weight gain – 1100°C (2010°F).

KANTHAL APMT is Clean and Maintenance Free in Operation

In addition to being sag free, when KANTHAL APMT is used as part of an SER burner tube assembly, the non-scaling properties of the protective alumina oxide eliminates the need to periodically dismantle the burner assembly to clean out scale from the inside of the tubes, as is the case with nickel chrome based alloy tubes, to prevent clogging of the combustion systems.

The protective alumina film resists spalling during thermal cycling, thus will not contaminate products in the furnace, or cause electrical short circuits in any heating elements installed inside KANTHAL APMT protection tubes.

KANTHAL APMT tubes require no maintenance during operation, which means fewer production stoppages.

KANTHAL APMT is Practically Immune to Carburization, Sulphidation, and Metal Dusting

The protective alumina scale also provides KANTHAL APMT tube excellent high temperature corrosion resistance to carburization and sulphidation.

Figure 4 Comparison of APMT Tube vs. Fe-35Ni-25Cr (after 2300 h at 1100°C (2010°F)). The FeNiCr tube is severely contaminated with oxide flakes.

KANTHAL APMT remains completely unaffected by the carbon attack that causes NiCr based alloy tubes to degrade and eventually fail.

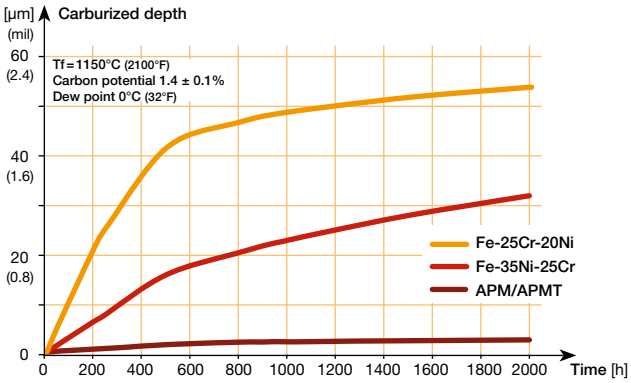

Figure 5 Carburization resistance.

Even in applications where an extremely high level of carbon potential is used, including those where free carbon is allowed to precipitate, Carbon does not penetrate into, or adhere to KANTHAL APMT.

Carbon Resistant KANTHAL APMT Tubes Exhibit Excellent Resistance to Coking

The protective alumina layer does not catalyze coke formation, unlike the surface oxide on NiCr materials.

In addition to KANTHAL APMT being nickel free, and hence inherently free from the destructive nickel sulphide formation that affects NiCr based alloy tubes, the high stability of the protective surface oxide prevents corrosion of KANTHAL APMT tubes in highly sulphurous atmospheres.

Figure 6 Comparison of carbon build-up in a strand annealing furnace, NiCr (left) and APM/APMT (right).

Furthermore, KANTHAL APMT does not suffer from metal dusting, a severe form of localized carbon attack that can occur in NiCr based alloys in the temperature range 450 to 800°C (840 – 1470°F).

KANTHAL APMT Delivers Higher Productivity and Flexibility

KANTHAL APMT tubes can be used to upgrade existing furnaces for higher production throughput, or for higher temperature use. Both continuous and intermittent batch furnaces may be upgraded to address increased production demands.

By utilizing the high loading capability of KANTHAL APMT, the power input to existing furnaces may be substantially increased. This could allow more material to be processed through the furnace, or in some cases for the furnace to be speeded up. In cyclic batch processes, the load density may be increased, or the heating rate up to the process temperature reduced, resulting in shorter cycle times, and the ability to process more batches per day.

Both gas and electric furnaces can be upgraded with KANTHAL APMT.

Figure 7, demonstrates that the loading capability of KANTHAL APMT can be more than double that of NiCr/FeNiCr alloy tubes.

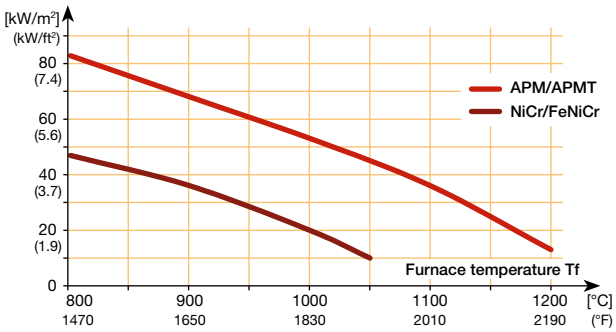

Figure 7 Power output SER-burner systems.

Existing furnaces may also be upgraded to operate at higher process temperatures with KANTHAL APMT, thereby increasing the flexibility of existing equipment. In some cases, even eliminating the need to invest in a new furnace.

Features and Form Availability

Extruded Tubes

KANTHAL APMT tubes are formed by hot extrusion from isostatically consolidated powder preforms. There are no welded seams, thus eliminating a source of potential failure.

Higher Temperature Capability

KANTHAL APMT tubes can operate at temperatures up to 1250°C (2280°F).

Lower Weight, and Thinner Walls than Centrifugally Cast Tubes

Due to approx 10 % lower density, KANTHAL APMT tubes weigh less than NiCr and FeNiCr tubes of equivalent dimensions. Furthermore the wall thickness of KANTHAL APMT tubes is generally less than spun cast tubes.

Fabrication and Machinability

KANTHAL APMT tube is machinable and can be supplied as complete, ready to install assemblies, with welded flanges, closed ends, support extensions, o-ring grooves, threaded extensions, etc.

Hangers and support systems for horizontal mounting are available in a variety of forms, depending on the application.

Wide Range of Sizes Available

KANTHAL APMT tubes are produced is a wide range of sizes between 26 mm and 260 mm (1.02 – 10.24 in).

Complete System Solutions

KANTHAL APMT tubes can be provided as part of a complete Kanthal heating system package together with Kanthal GLOBAR®, KANTHAL® Super or TUBOTHAL® heating elements, according to the application requirements.

Applications

High Mechanical Strength and Form Stability Combined with Superior Corrosion Resistance

KANTHAL APMT has been developed to address applications where the mechanical strength of KANTHAL APM has been found to be insufficient, yet would have otherwise greatly benefited from the superior oxidation properties of KANTHAL APM.

KANTHAL APMT is the natural choice for applications requiring:

- Longer horizontal span widths
- High degree of form stability
- High process temperatures
- High powered systems
- Upgrading of existing tube performance
- High Carbon Potential

Kanthal – a Member of the Sandvik Group

The Sandvik Group is a global high technology enterprise with 41,700 employees and annual sales of approximately SEK 72 billion. Sandvik spends about 4 percent of is turnover on research and development. As a member of the Sandvik Group, Kanthal has full access to world-class competence within materials and process technology, as well as Sandvik's R&D-center in Sweden, which is one of the most distinguished in the world. Through Sandvik's global sales organization Kanthal is represented in 130 countries.

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