

**KANTHAL®**

# HIGH-TEMPERATURE METALLIC ALLOY TUBES

KANTHAL® APMT TUBES



# 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:

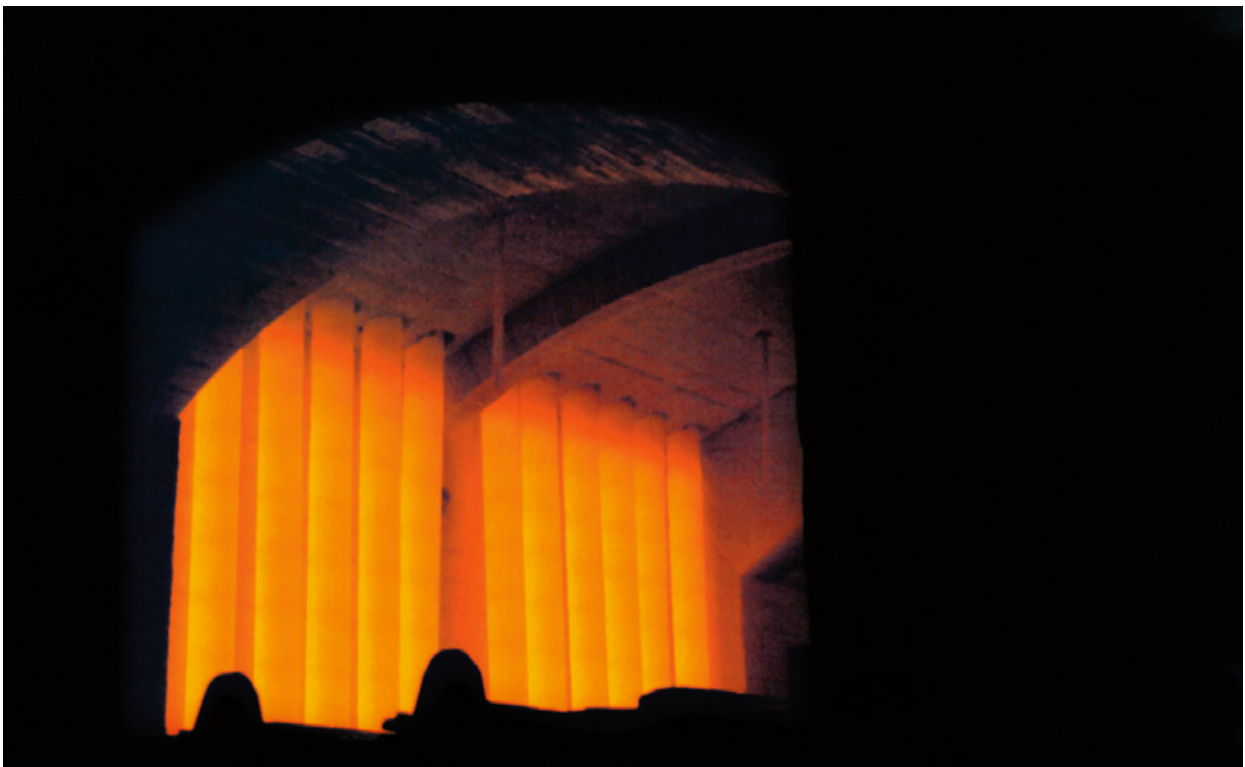
- Higher productivity
- Faster heating response
- Faster furnace throughput
- Shorter cycle times
- Higher process temperature capability
- Longer life
- Cleaner operation
- Maintenance free operation

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 powder metallurgy alloy, now offers all the benefits of the well proven Kanthal® APM material, but much stronger, even stronger than NiCr/FeNiCr alloys.

## SPECIAL FEATURES

- High mechanical strength
- Excellent high temperature corrosion resistance
- Superior oxidation properties



**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.

**KANTHAL 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 the diagram Sample weight gain, the superb oxidation properties of Kanthal® APM have been maintained in Kanthal® APMT. The image to the right shows the alumina oxide layer of Kanthal® APMT compared to Fe-35Ni-25Cr.



**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.

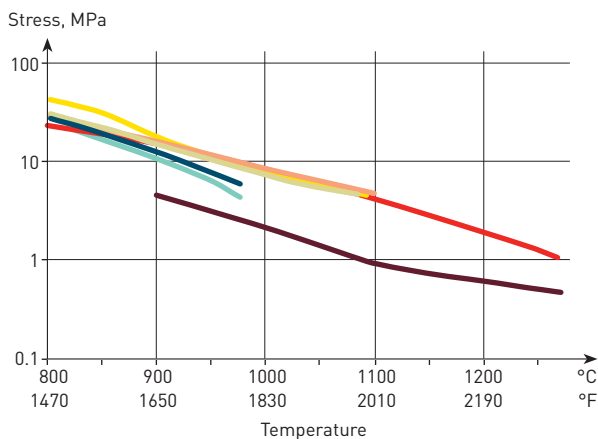
**KANTHAL® APMT IS PRACTICALLY IMMUNE TO CARBURIZATION, SULPHIDATION, AND METAL DUSTING**

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

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

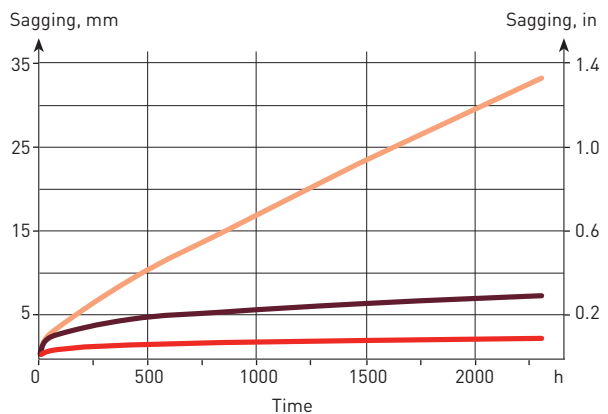
Even in applications where an extremely high level of carbon potential is used, including those where free carbon is allowed to precipitate, Carbon does not penetrate into, or adhere to Kanthal® APMT.

**CREEP RUPTURE STRENGTH - 10000 H**



■ Kanthal® APM ■ Kanthal® APMT ■ Fe-35Ni-25Cr  
 ■ Alloy 800HT ■ HK40 ■ HP40 ■ Inconel 601

**COMPARATIVE SAGGING TEST AT 1100°C (2010°F)**



■ Kanthal® APM ■ Kanthal® APMT ■ Fe-35Ni-25Cr

**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.

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.

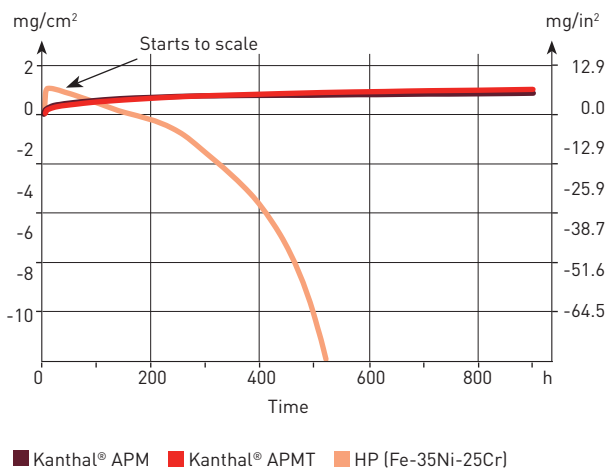
The diagram Power output SER-burner systems, demonstrates that the loading capability of Kanthal® APMT can be more than double that of NiCr/FeNiCr alloy tubes.

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.

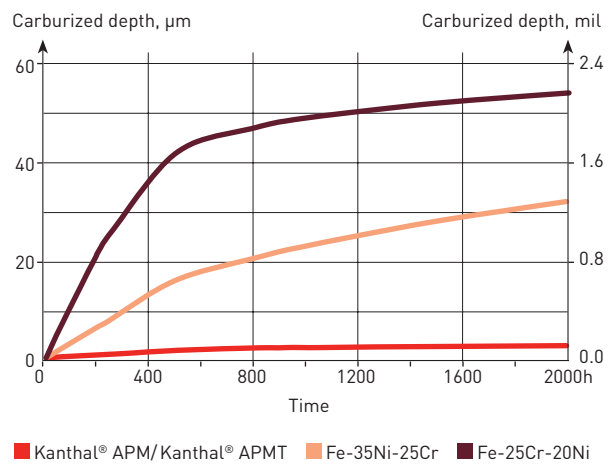


Comparison of Kanthal APMT tube vs. Fe-35Ni-25Cr (after 2300 h at 1100°C [2010°F]). The FeNiCr tube is severely contaminated with oxide flakes.

**SAMPLE WEIGHT GAIN – 1100°C (2010°F)**



**CARBURIZATION RESISTANCE**



Tf = 1150°C (2100°F)  
Carbon potential 1.4 ± 0.1%  
Dew point 0°C (32°F)

## FORMS OF SUPPLY

### 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 in 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 Global®, Kanthal® Super or Tubothal® heating elements, according to the application requirements.

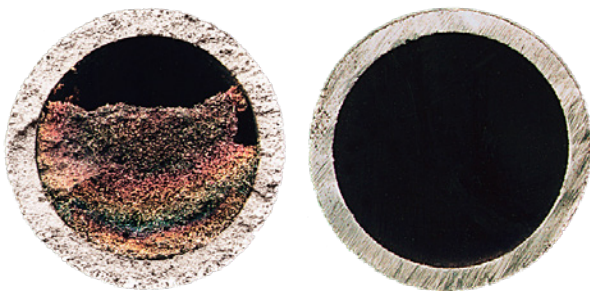
## APPLICATIONS

### 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.

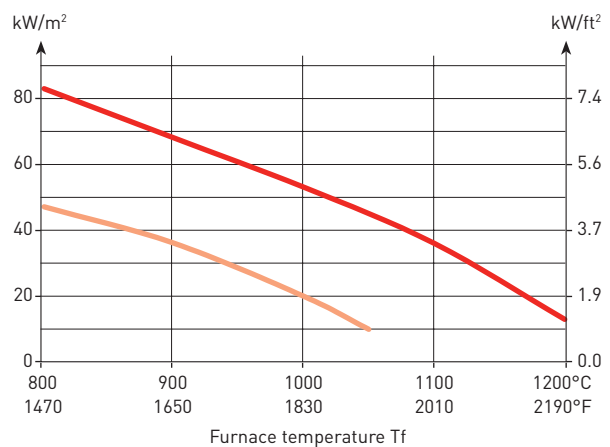
Kanthal® APMT is the natural choice for applications requiring:

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



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

## POWER OUTPUT SER-BURNER SYSTEMS



■ Kanthal® APM/Kanthal® APMT ■ NiCr/FeNiCr

