



KANTHAL APMT™ material presentation

Roger Berglund

Sandvik Materials Technology

Sandvik Group – a global leader

Three business areas

Sandvik Tooling



Sandvik Mining and Construction



Sandvik Materials Technology



Invoicing
MSEK
Employees

19 078

15 296

32 621

14 429

15 328

8 246

31 Dec. 2009

Sandvik Materials Technology

KANTHAL APMT™ material presentation



Sandvik Group – organizational structure

SANDVIK GROUP

Business Areas:

Sandvik Tooling
Tools and tooling systems for metal cutting, blanks and components.

Sandvik Mining & Construction
Equipment, tools and services for mining and construction.

Sandvik Materials Technology
Stainless steel and special alloy products for niche applications, resistance materials and steel belt process systems.

Product Areas:

Tube

Strip

Wire and Heating Technology

Sandvik Process Systems

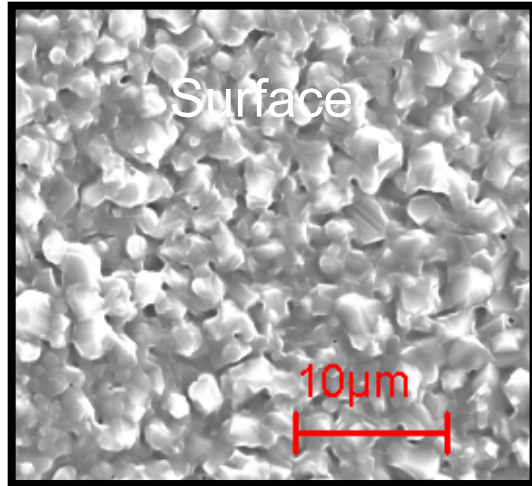
Sandvik MedTech

Sandvik Materials Technology

KANTHAL APMT™ material presentation

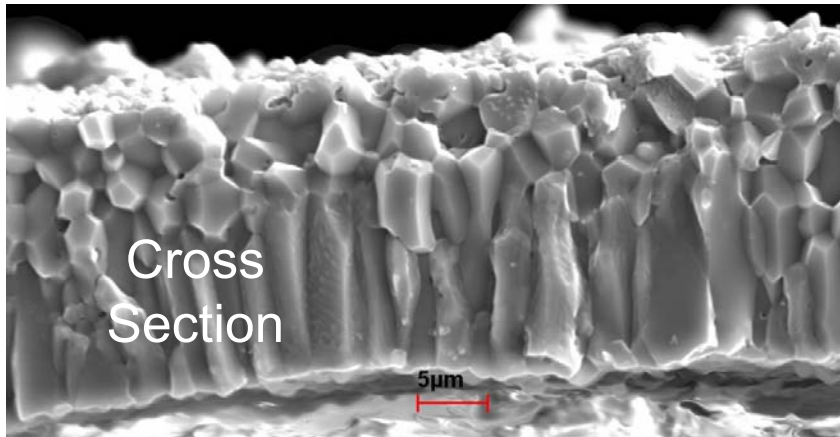


Alumina scale on FeCrAl Alloys



α -alumina Al_2O_3

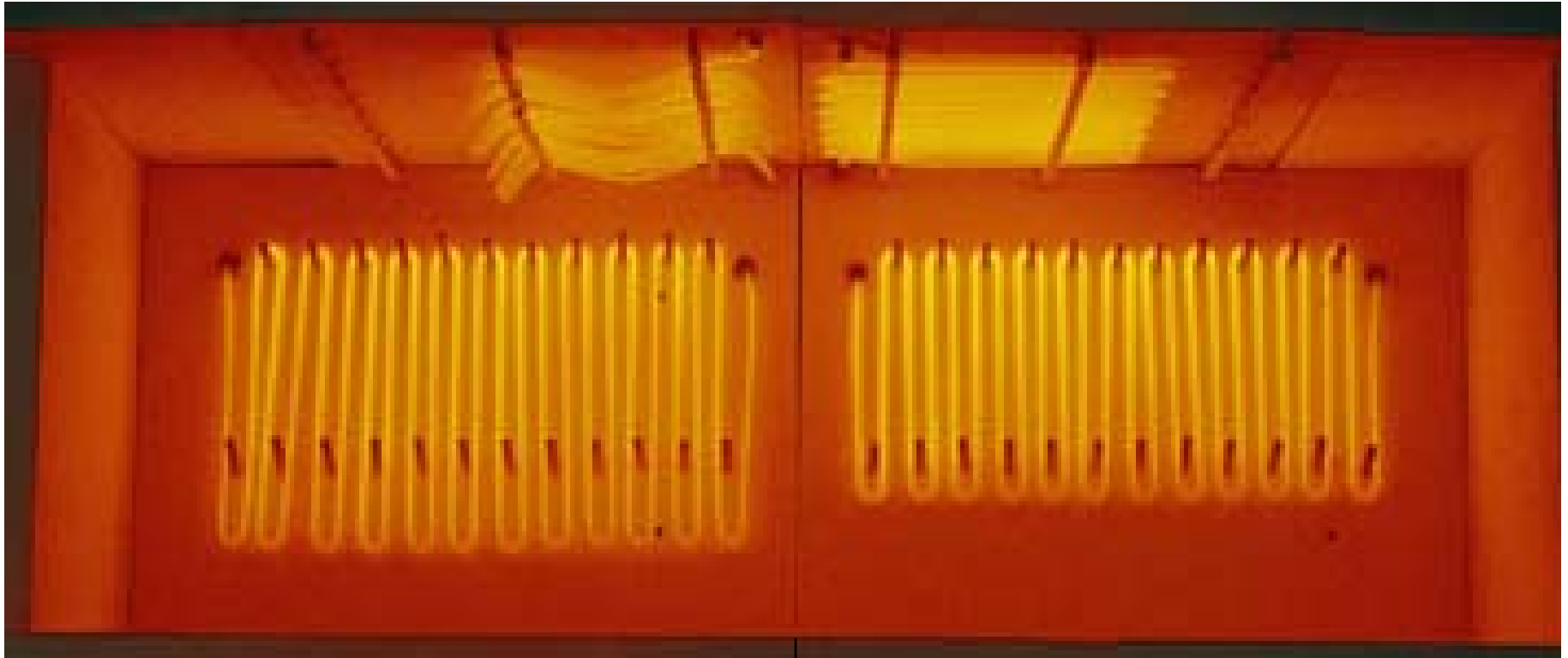
- ✓ Thermodynamically stable
- ✓ Non-volatile
- ✓ Inert
- ✓ Dense
- ✓ Thin
- ✓ Slow growth
- ✓ Adherent



Reactive Element (RE) effect!

Conventional vs RSP FeCrAl

Ø9,5 mm wire heaters after 500 h at 1300-1400°C (2372-2552°F)

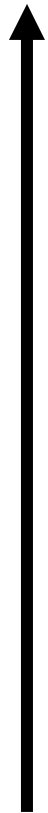


Conventional FeCrAl alloys
Severe elongation and deformation

RSP FeCrAl (KANTHAL APM)
Form stability and low elongation

Development of Creep Resistant FeCrAl-alloys

Creep Strength
& Price



ODS MA FeCrAl Alloys

RSP KANTHAL APMT™ Alloy

RSP FeCrAl Alloys

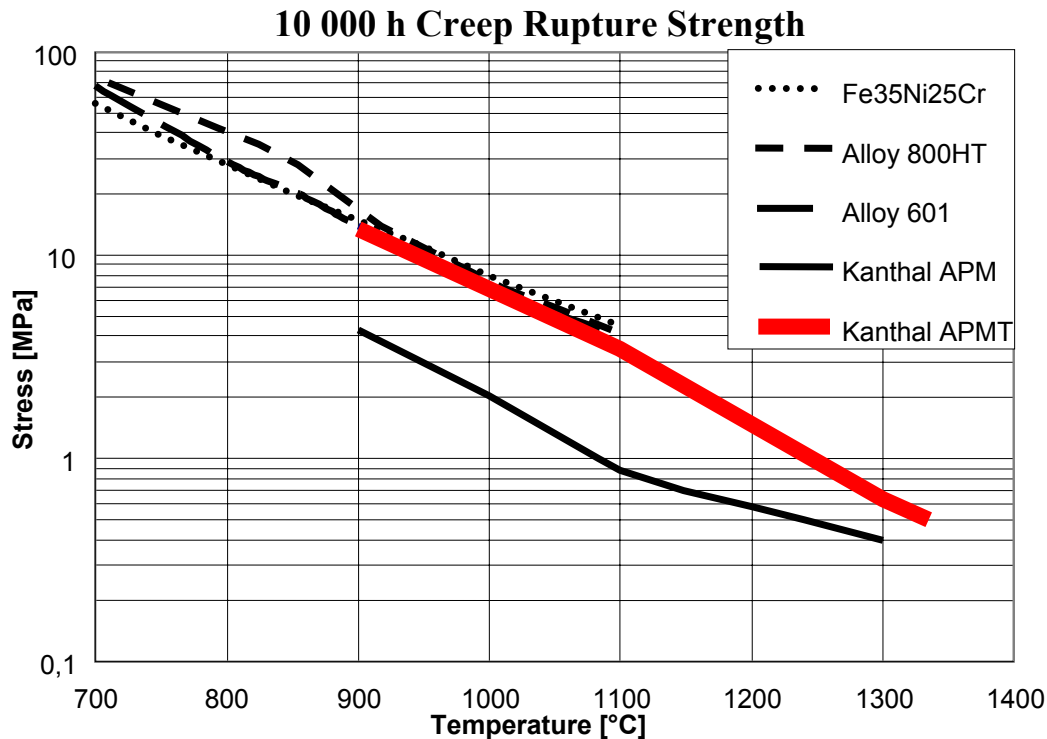
(KANTHAL APM)

Conventional Metallurgy

(ex. KANTHAL A-1)

PM based KANTHAL alloys

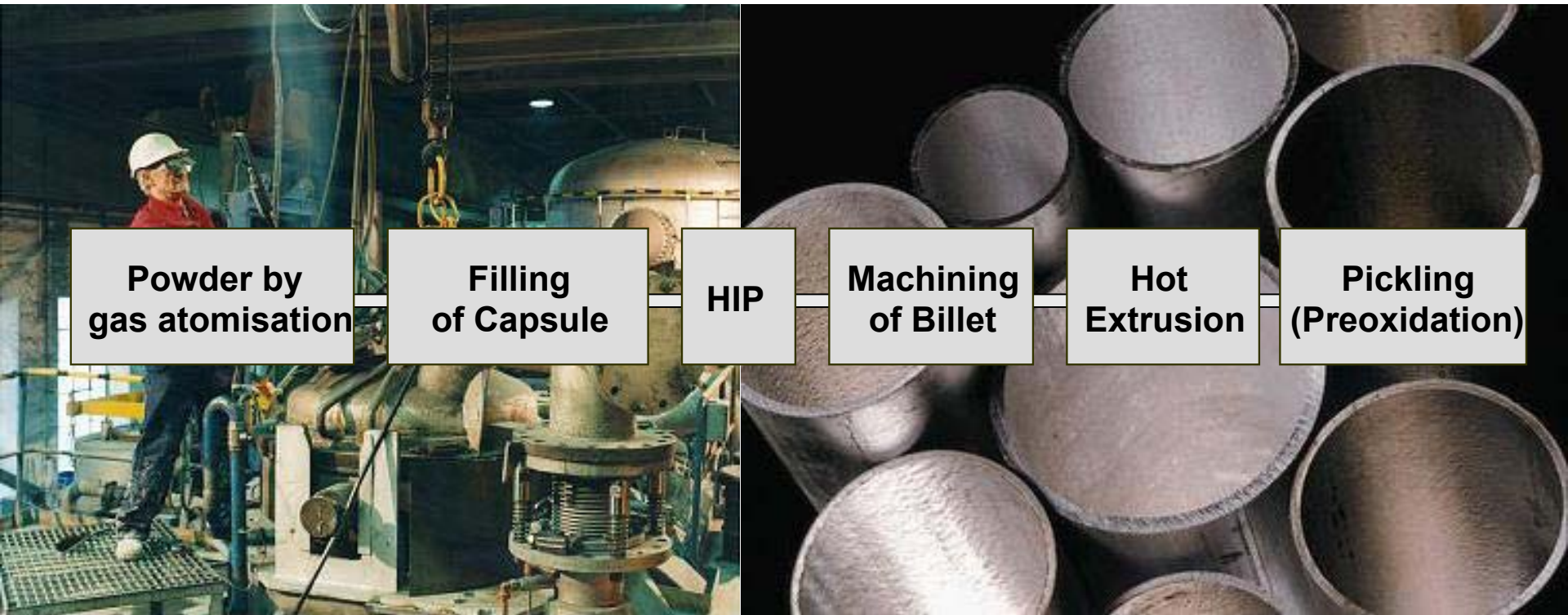
Composition (wt%)	Fe	Cr	Al	Mo	Si	Mn	C	Minor additions
KANTHAL APM	Bal.	22	5.8		<0.7	<0.4	<0.05	Present
KANTHAL APMT	Bal.	22	5.0	3.0	<0.7	<0.4	<0.05	Present



Production of PM HIP:ed materials

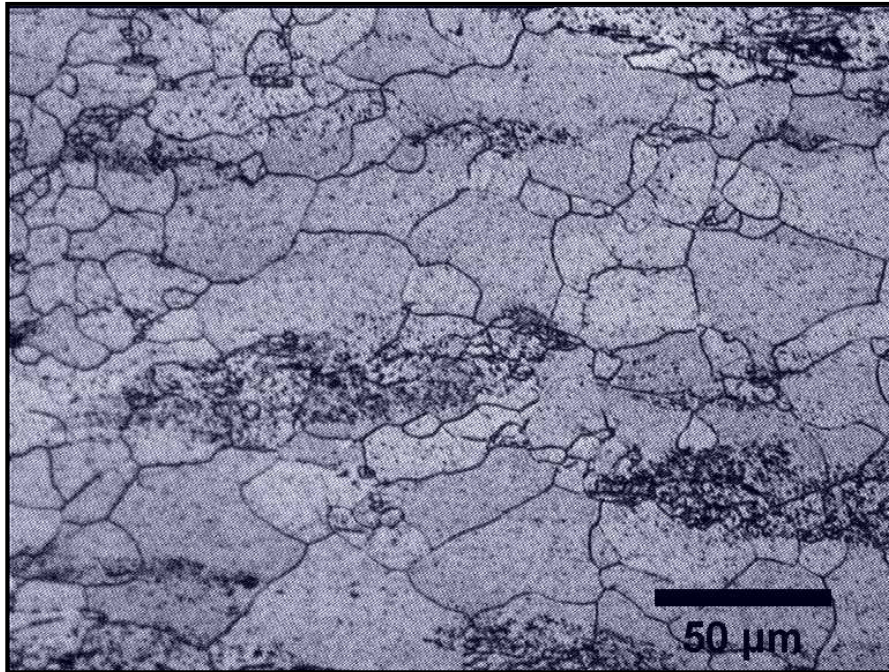


Process Route for Tubes

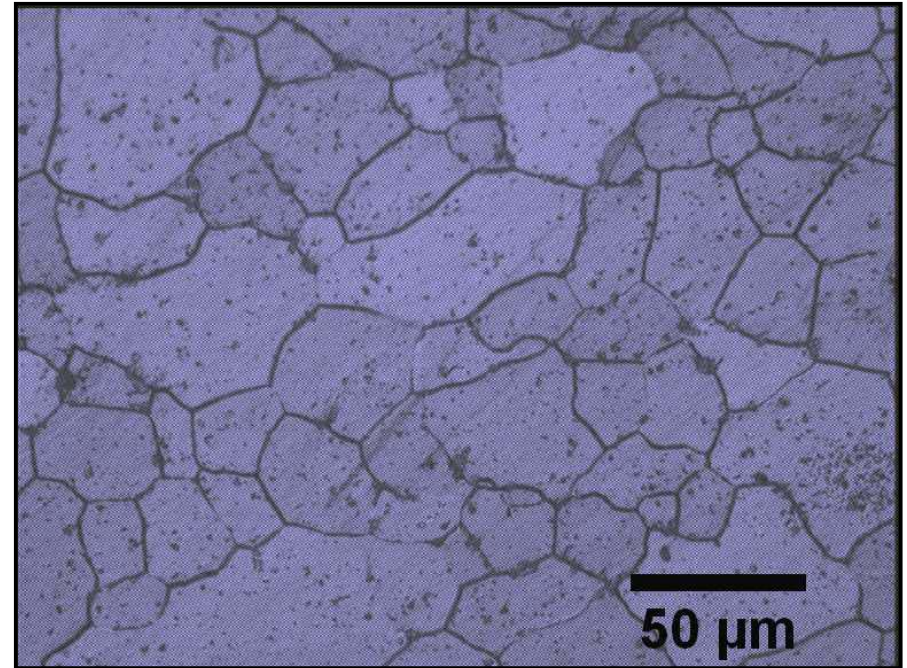


Grain Structure Kanthal APMT tubes

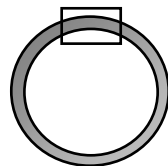
Grain Stability



Delivery State



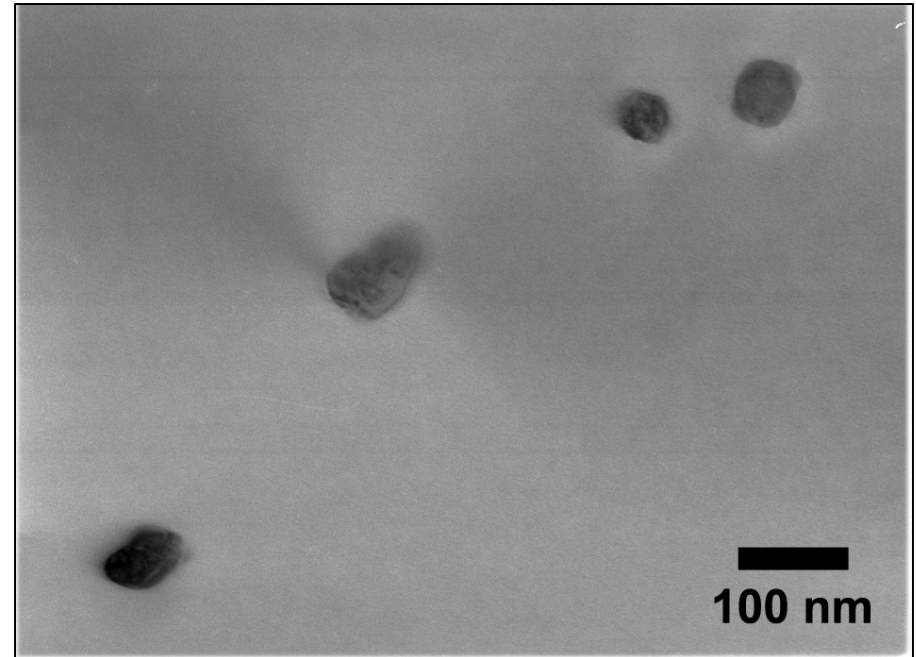
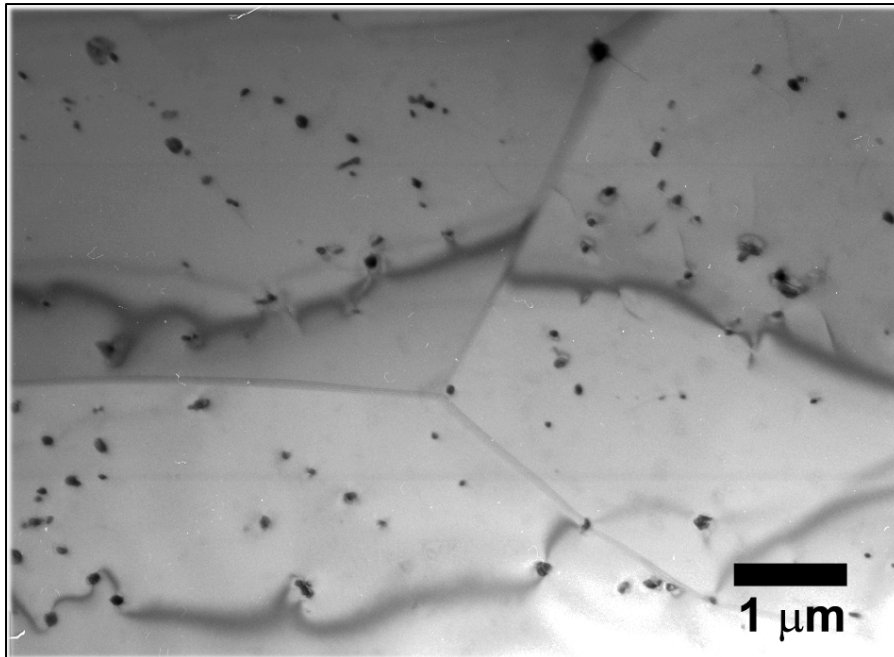
Creep tested at 1200°C, 2000h



Cross Section

Dispersion in Kanthal APMT tube

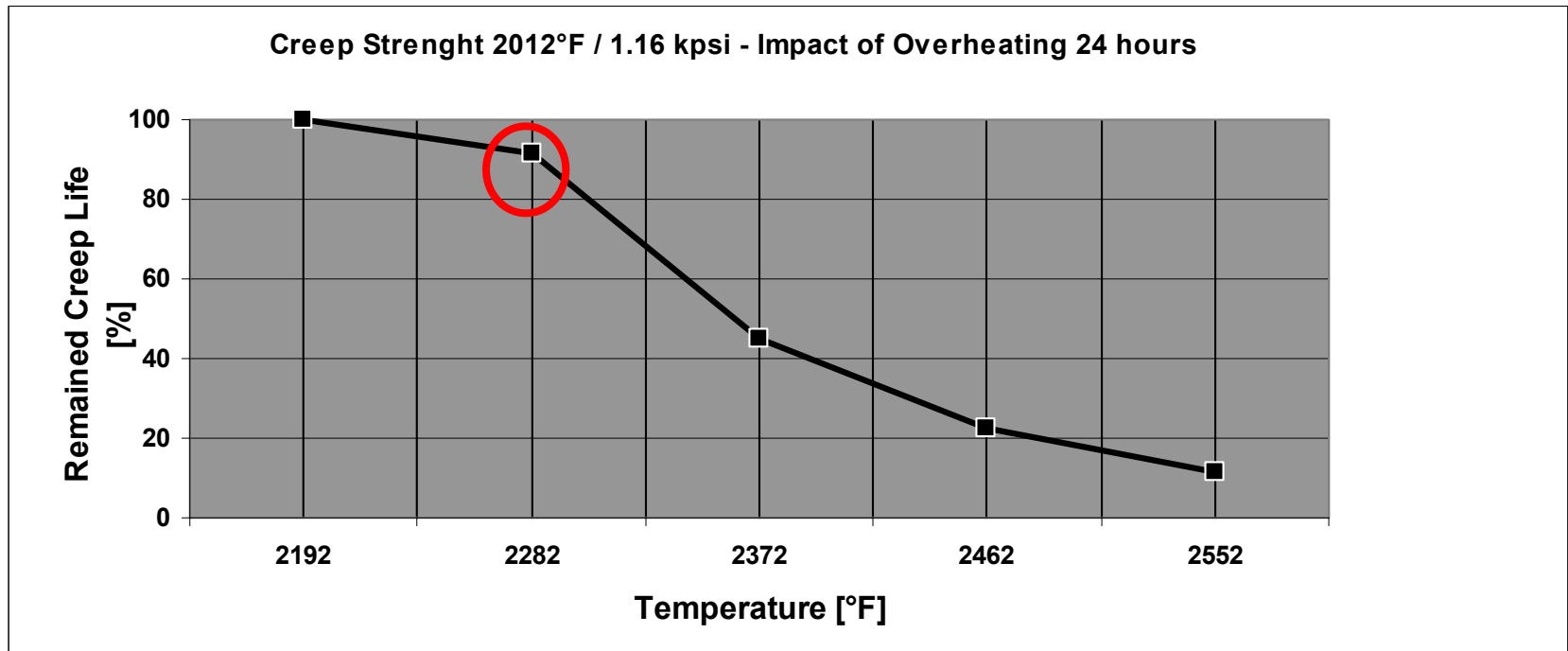
TEM, Bright Field Image



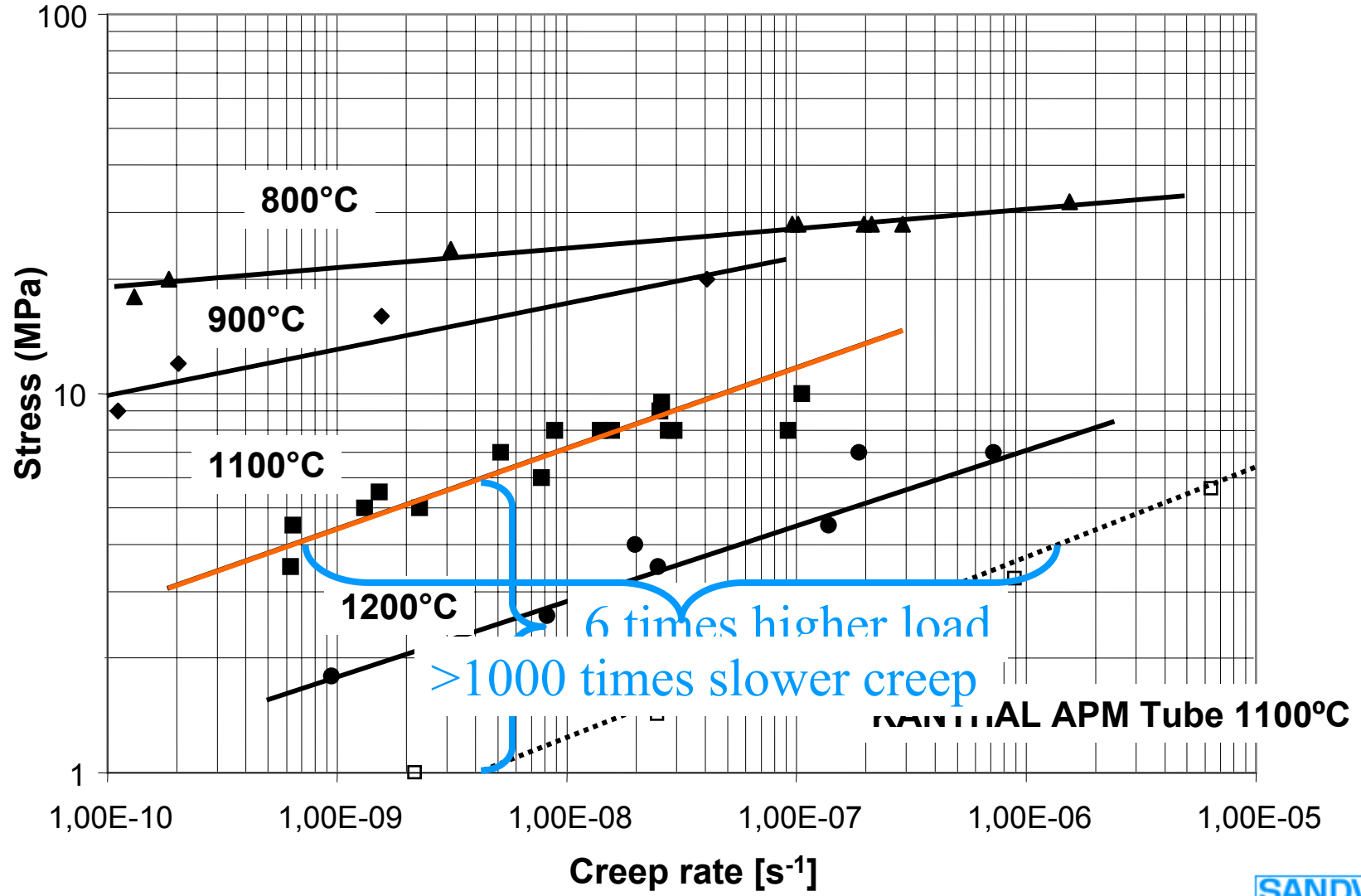
Average Particle Size: 75 nm
Average Particle Density: $12 \mu\text{m}^{-3}$

Overheating

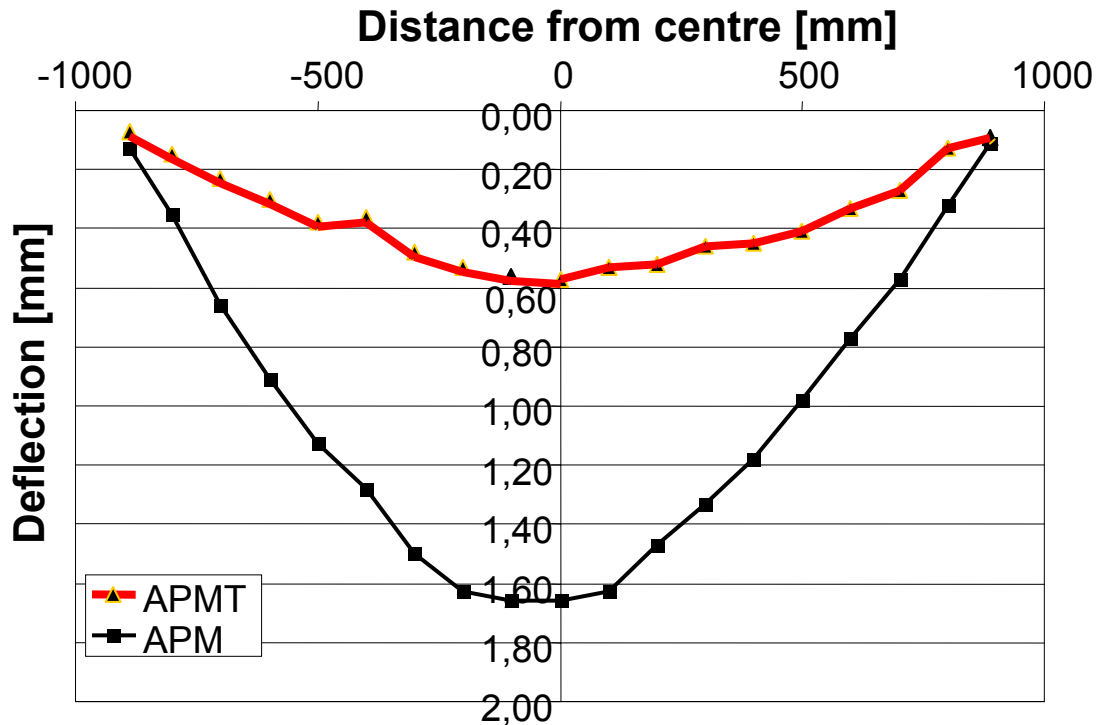
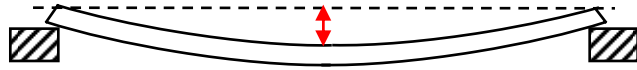
APMT can withstand temperature trips of 24h at 2282°F with Creep Properties maintained !



KANTHAL APMT Sec. Creep Rate



Gravitational deflection of horizontal tubes



KANTHAL APMT Fe35Ni25Cr

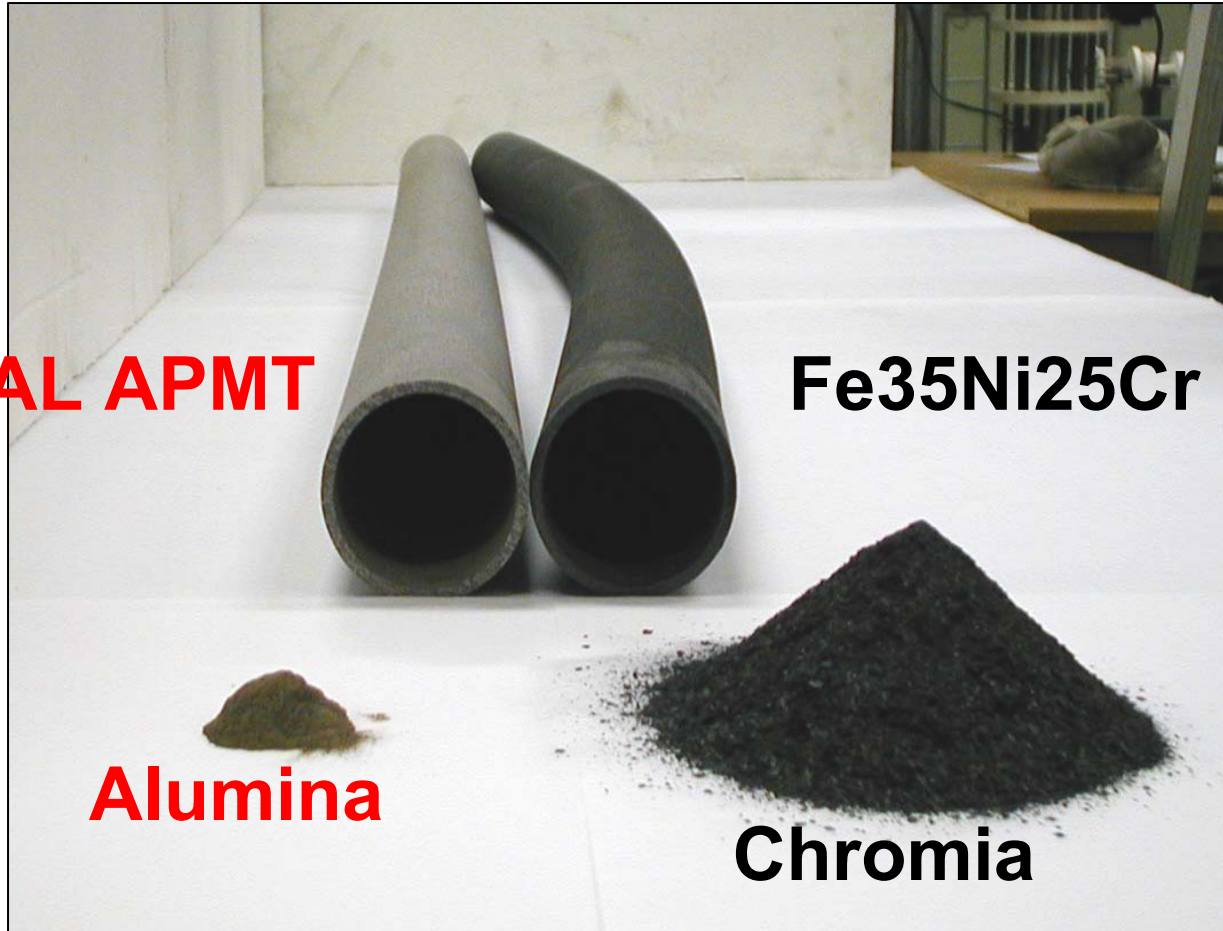
Oxide spallation.

KANTHAL APMT

Fe35Ni25Cr

Alumina

Chromia



Joining techniques

- KANTHAL APMT is weldable if WPS is followed.
- Recommended methods TIG (GTAW), laser welding
- Preheating and PWHT is necessary.
- APMT filler is recommended.

- However a loss of creep strength is unavoidable due to remelting of RSP structure.

- Solid state welding techniques are being evaluated.
- Vacuum brazing also possible.



Applications for KANTHAL APMT



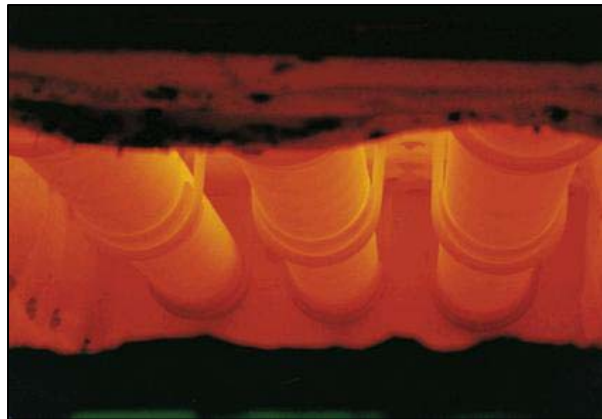
Wire mesh belts



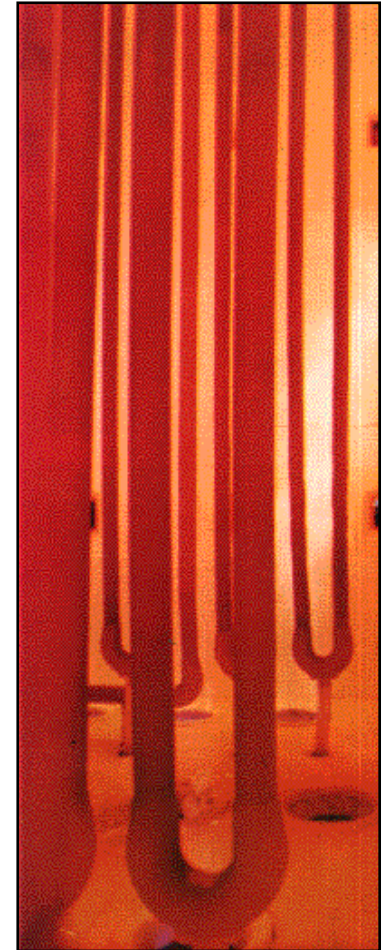
Furnace rollers



Furnace furniture



Radiant tubes



Ethylene tubes

KANTHAL APMT applications



Loading cage rings for HIP presses.



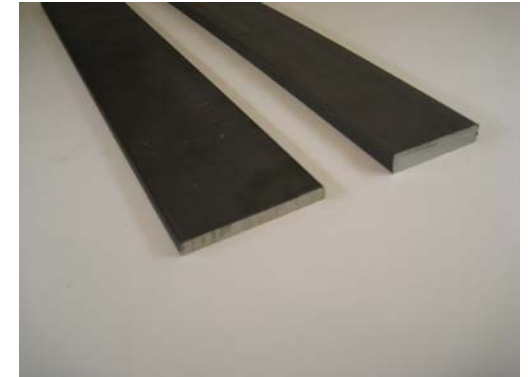
KANTHAL APMT product forms

Wire and strip



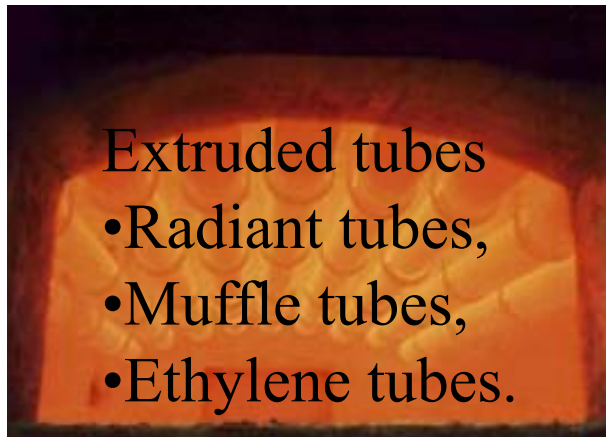
Hot rolled

- Billets,
- Bars,
- Rod,
- Profiles
- Rings



Extruded tubes

- Radiant tubes,
- Muffle tubes,
- Ethylene tubes.



Fabricated components/products

NNS HIP components

Fore more information

www.kanthal.com

THANK YOU FOR LISTENING!