

## ELECTRIFCATION OF HEATING PROCESSES

DILIP CHANDRASEKARAN BUSINESS DEVELOPMENT MANAGER STEEL, KANTHAL



## SAFETY FIRST

Kanthal's objective is zero harm to our people, the environment we work in, our customers and our suppliers.





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### INTRODUCTION TO KANTHAL

WHY ELECTRIFICATION OF HEATING PROCESSES

ELECTRIFICATION AS ENABLER FOR FOSSIL FREE STEEL

APPLICATION EXAMPLES WITHIN STEEL PROCESSING CONTINUOUS ANNEALING

SUMMARY AND CONCLUSIONS



## OUR PURPOSE IN THE FOREFRONT OF SUSTAINABLE HEATING TECHNOLOGY TO IMPROVE LIFE FOR PEOPLE AND PLANET

Green Steel World 2023



## KANTHAL – BRAND FOR HEATING TECHNOLOGY

- Heating Materials resistance heating and high temperature alloys for temperatures up to 1850°C
- Heating Systems products, components, systems and services for thermal processing
- Broadest range of products and systems for industrial heating, from raw material to finished products
- Global R&D-organisation with in-depth competence within high temperature materials and applications





## WE ACCELERATE ELECTRIFICATION FOR A SUSTAINABLE FUTURE



## ELECTRIFICATION BENEFITS

Five key benefits of electric heating compared with fossil

Up to 95% efficiency

Excellent temperature control: ± 1°C

Reduction of CO2 emissions, zero if renewable energy is used

Elimination thermal NOx and SOx emissions

Safer and quieter production environment





## ENABLER – GAS TO ELECTRIC

- Unique high temperature materials portfolio
  - Metallic materials (NiCr and FeCrAl) upto 1400°C
  - Globar<sup>®</sup> SiC upto 1600°C
  - Kanthal<sup>®</sup> Super MoSi2 upto 1850°C
- Wide range of temperatures and atmospheres
- Extensive application know-how
- Pilot-scale testing and Modelling capabilities





## PRODUCTS AND SOLUTIONS FOR FOSSIL FREE PRODUCTION







Resistance materials and Heating solutions















## ELECTRIC POTENTIAL IN STEEL MAKING





Ironmaking (Main CO2-source)

- Pre-heating of gas in BF
- Heating of hydrogen for DRI

Steelmaking

- Ladle heating
- Tundish heating
- Ingot heating
- Re-heating (Major CO2-source)
- Annealing



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## ELECTRIC GAS HEATING -IRONMAKING





## ELECTRIC PROCESS GAS HEATING SOLUTIONS



### **HEATING CASSETTES**

Forced convection furnaces

Air/gas T ≤ 800°C

Compact element design (Porcupine) for optimized heat transfer and maximized power outputs.

**KANTHAL® FLOW HEATERS** 

customized solutions for higher

Air and gas heating

Outlet  $T \le 1100^{\circ}C$ 

power levels

Compact design

Standard 3.5-60 kW and





# KANTHAL<sup>®</sup> PGH 1 Air and gas heating Outlet T ≤ 1100°C 100 kW to 100' s MW Pressures ≤ 10 bar Low pressure drop

**KANTHAL® PGH 2** Air and gas heating Outlet  $T \le 1100$  °C 100 kW to 100' s MW Pressures  $\le 10$  bar Robust design



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## **CONTINUOUS ANNEALING**



## CURRENT HEATING SOLUTION

- Continuous furnaces for annealing and galvanizing of steel strip
- Atmosphere: 95%N2-5%H2, Temperature around 1000 C
- Heated with gas burners in Ni-Cr radiant tubes (W, U, P-type)
- Large power requirement (100-200 kW per burner) or 20-30 MW per furnace





## ELECTRIFICATION OF CONTINUOUS ANNEALING

- One gas-fired W-tube can be replaced with two electric heating units (Tubothal<sup>®</sup> and radiant tube)
- Eliminate emissions
- Higher efficiencies
- High temperature control
- Lower maintenance
- Longer lifetime





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## LADLE AND TUNDISH HEATING

- Heating of tundishes and ladles in secondary steelmaking drying and pre-heating processes
- Current state gas-fired, open burners with low overall efficiency, noisy and generating CO2-emissions
- Challenges with power density, heating times and heating bottom of large ladles
- Electrification with ceramic heating solutions (SiC, MoSi2) *Remove emissions, Quiter, Temperatur control*







## **RE-HEATING FURNACES**

- Heating of slabs, billets and other product forms prior to forming operations
- Typically gas fired (open burners) with large power requirement (10-50 MW per furnace), high power density and temperature
- Electric heating solution validated on smaller scale @Kanthal
- Scale-up and develop for continous 24/7 operation
- Remove emissions, higher thermal efficiency, improved yield (controlled atmosphere)









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## SUMMARY AND CONCLUSIONS

- Large-scale heating solutions needed to replace existing heating with gas-burner technology for steel industry
- Resistance heating offers potential to replace fossil-fired heating to CO2-free in steel operations
- New large-scale electric heating solutions
   under development
- Challenge in reaching required power density, temperature and robust solution
- Vital with collaborations and partnerships across businesses and organisations



## WE KNOW ELECTRIC HEATING TECHNOLOGY

## THANK YOU! QUESTIONS?



