

# Soluciones innovadoras a la corrosión: TUBACOAT como recubrimiento cerámico

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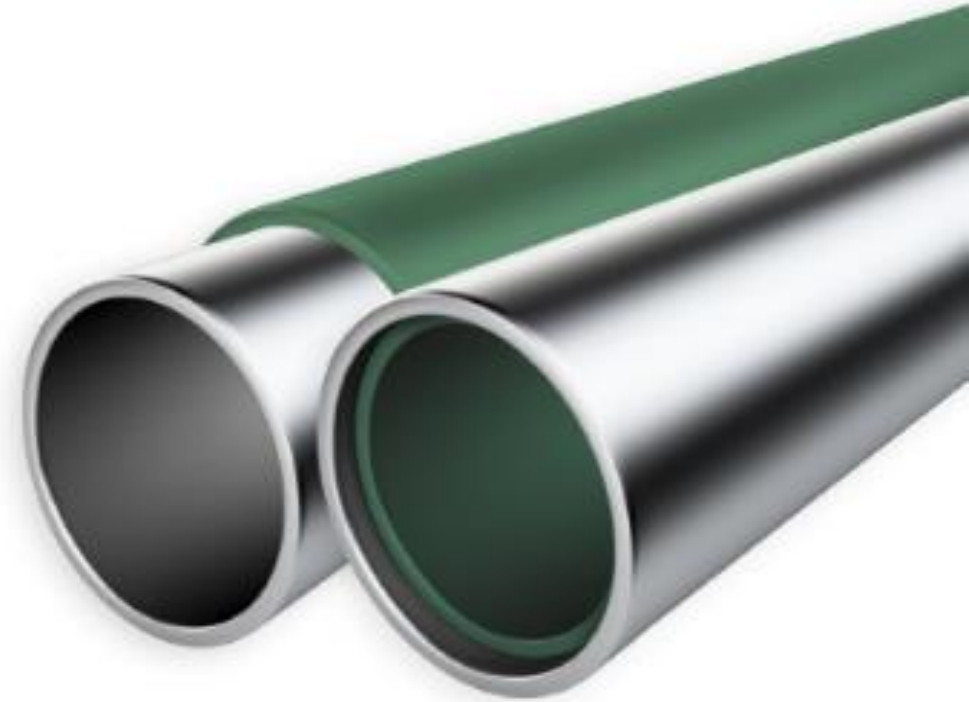
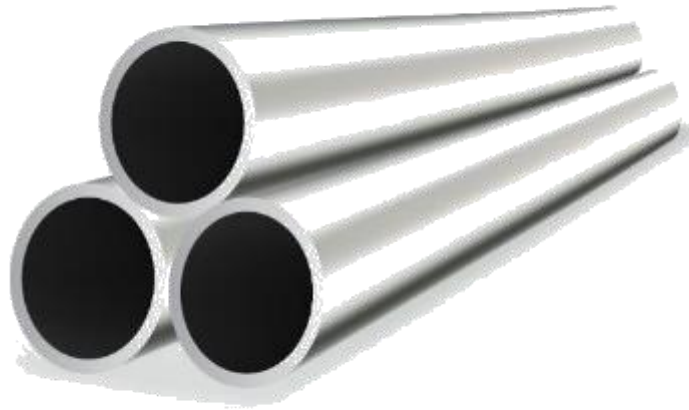


## KEY FACTS

- Worldwide leading supplier of SSSP with the widest portfolio in the market
- 12 mills, commercial presence and own stocks and service centers worldwide.
- Fully integrated manufacturing process.
- More than 300 customers in over 100 countries.
- 2300 professionals.



Worldwide leading supplier of SSSP



1



## MORPHOLOGICAL

- **Continuous coating layer**  
Thickness control based on suspension parameters & rheological properties
- **Roughness**, decrease  $\approx 97\%$  minimizing particle adhesion
- Good **chemical bonding** between metal substrate and ceramic coating

## MECHANICAL

- **Hardness & Elasticity**  
Coating is harder than substrate but less elastic
- **Abrasion resistance**  
 $\approx 94\%$  decrease in mass loss
- **Good adherence**. Impact test: No coating detachments at medium loads



## CHEMICAL

- **High corrosion resistance** compared to base material

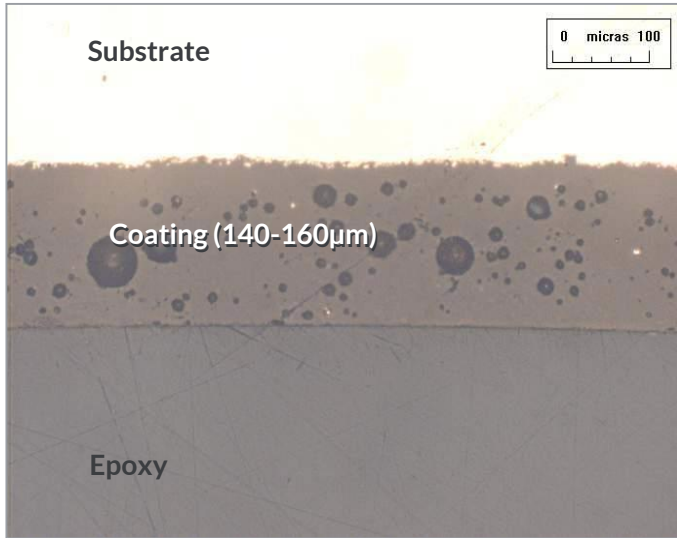


## THERMAL

**Thermal resistance**  
Good performance under thermal cycling  
No delamination - No cracks

**Thermal conductivity**  
Thermal conductivity range  $\approx 5-8$  W/mK = f(T) Average (reference) 6 W/mK

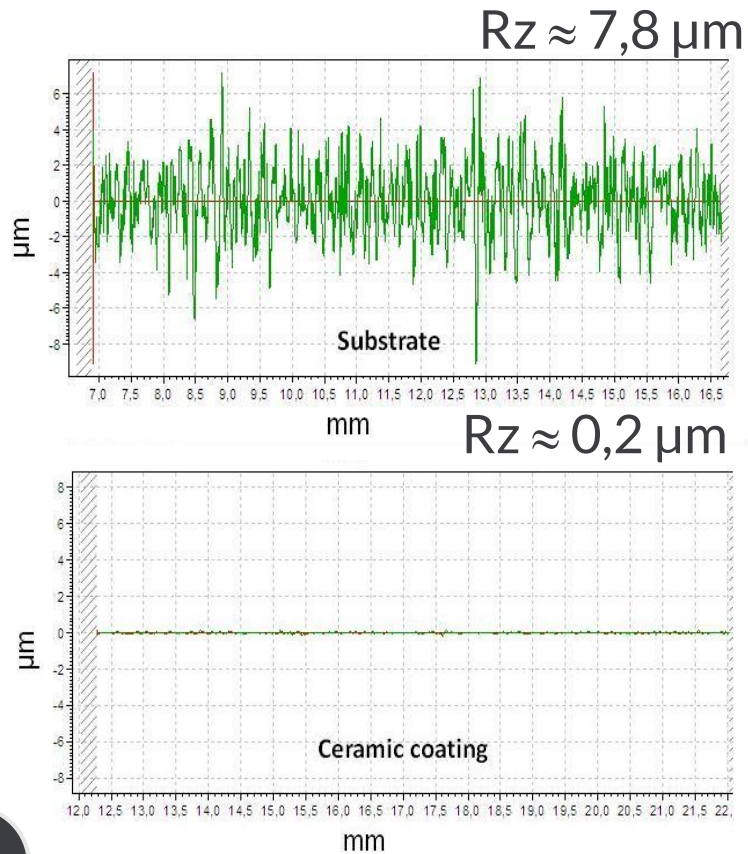
## Morphological



1

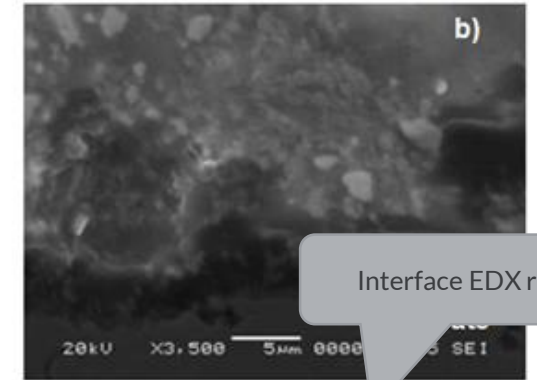
### Continuous coating layer

Thickness control based on suspension parameters & rheological properties

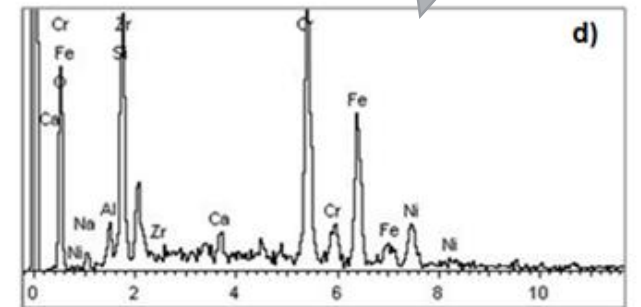


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**Roughness**, decrease  $\approx 97\%$   
minimizing particle adhesion



Interface EDX results





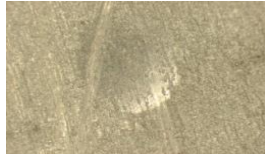

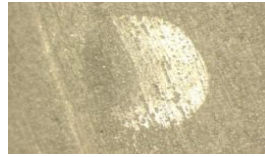
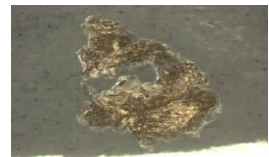
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Good **chemical bonding**  
between metal substrate  
and ceramic coating

## Mechanical

10000 cycles



Height	Stainless Steel	Ceramic coating
5 cm		
10 cm		
15 cm		

	Base Material	Ceramic coating
Hardness (HV)	220	840
Elastic Modulus EIT (GPa)	140	87

Elongation  $\approx$  1,2-1,5%

1

### Hardness & Elasticity

Coating is harder than substrate but less elastic

2

Taber test **Abrasion resistance**  $\approx$  94% decrease in mass loss

3

**Good adherence.** Impact test: No coating detachments at medium loads

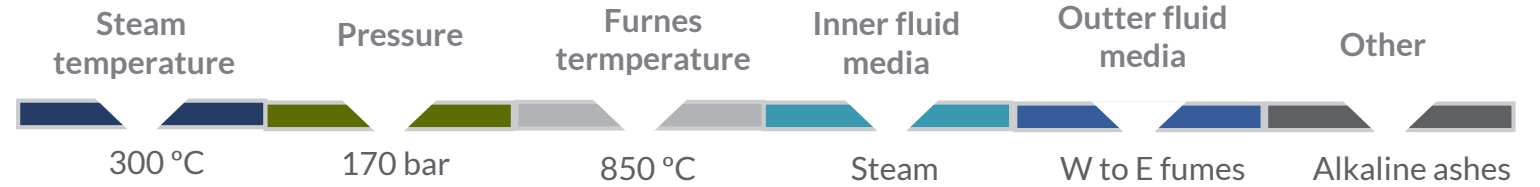
## High corrosion resistance compared to base material

- ✓ **Pitting Corrosion Resistance Solution: 5% NaCl, 25 °C and electrode potential to 1 mA/cm<sup>2</sup>**
- ✓ **Pitting Corrosion Resistance Method A-Ferric Chloride**
- ✓ **Seawater corrosion test Solution: 3,5% NaCl at 22°C**
- ✓ **Acid corrosion test Solution: 10% HCl at 22°C**
- ✓ **Molten salt corrosion test NaNO<sub>3</sub> + KNO<sub>3</sub> (60/40)**



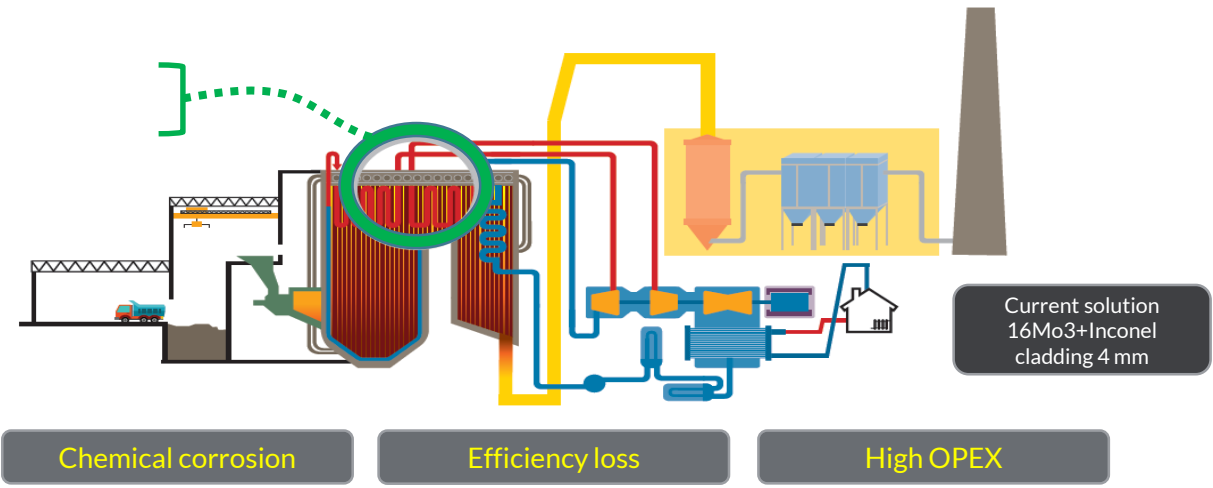
## Steam reheater & Thermocouple sheath

### ● Working conditions



### ● Applications

- Steam reheater
- Thermocouple sheath



## Steam reheater

### TUBACOAT SOLUTION

TP310H outer coated tubes  
vs 16Mo3 + Inconel overlay



### Results

- Low ash adherence
- Glossy surface after 2 years in operation
- Negligible loss of mass

### Conclusions

- Longer tube life expectation
- Improved thermal efficiency
- Possibility to increase thermal cycle temperature

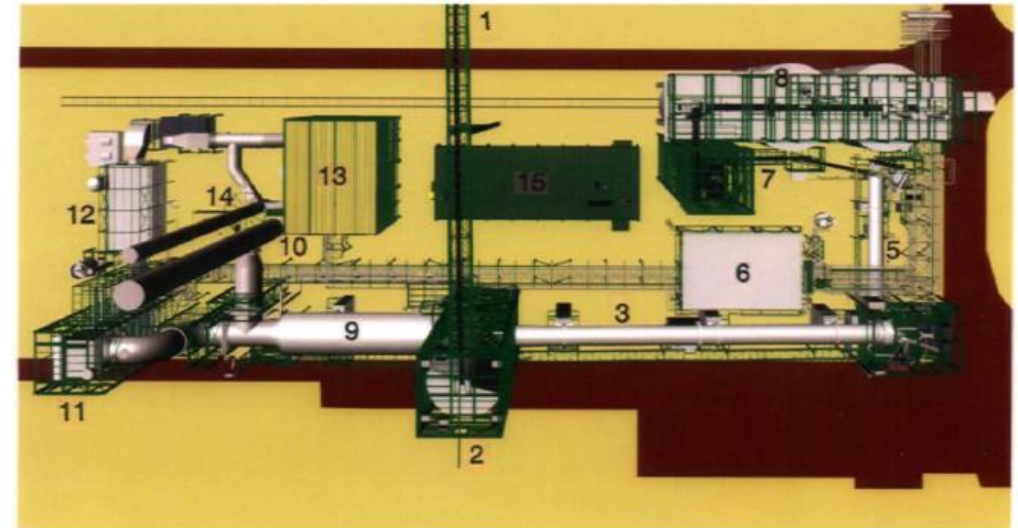
## Coke calciner

### ● Application

- Coke Calciner Recuperator

### ● Working Conditions

- Oil fumes rich in vanadates at 850°C
- Metal surface 570°C
- Low pressure (welded tube)



1 GREEN COKE CONVEYING BELT <sup>1)</sup>	6 AIR COOLER	11 WASTE HEAT BOILER
2 GREEN COKE FEED BIN	7 PRODUCT CONVEYING SYSTEM	12 BAGHOUSE DUST FILTER
3 ROTARY KILN	8 PRODUCT STORAGE SILOS	13 DESULPHURISATION UNIT
4 KILN FIRING BUILDING	9 INCINERATOR	14 STACK
5 (INDIRECT) COKE COOLER	10 EMERGENCY OR BY-PASS STACK	15 CONTROL - / MCC ROOM

Source: Technip Germany. Coke Calcining Plants June 2008

Current solution **TP310**  
(bare)



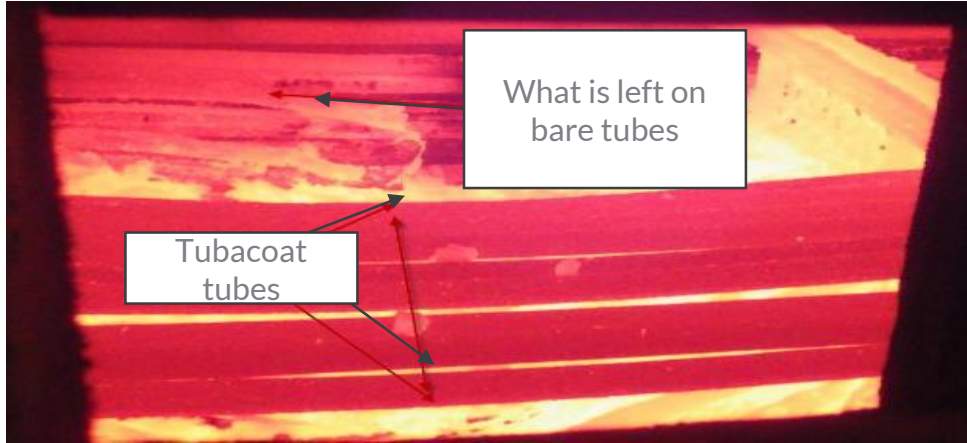
Chemical corrosion

Efficiency loss

## Coke calciner



10 months  
working



8 months  
working



**TUBACOAT  
SOLUTION**



## TUBACOAT Anti corrosión/erosion proposal

TUBACOAT  
SOLUTION

Refinery sector  
OUTER COATING



5000 mm, OD 30, WT 2,5



Overhead Condenser Crude distillation (corrosion/erosion)

## TUBACOAT Anti coke value proposal

- Coker (clogging)
- Visbreaker (clogging)
- Crude distillation (clogging)
- IGCC downstream lines (clogging)

TUBACOAT  
SOLUTION

### Vacuum Distillation Unit

Refinery sector



Inner COATING



317 Grade  
5500 mm, OD 141, WT 6,5



We are entering a stage of advanced design of equipment with great efficiency and, above all, with great availability.

THANK YOU!



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