

CORROSION AND FOULING RESISTANCE IN HIGH TEMPERATURE ENVIRONMENTS
TEMPERATURE > 450°C (850°F)

Application fields:

- Power generation boilers (Coal, Biomass, Urban garbage): water walls ,steam re-heaters, super heaters and heat recovery bundles
- Tubular systems of Molten salt solar power plants
- Ash corrosion and fouling in the Oil and Gas Industry (Visbreaker, Coke Unit, Coke Calciner, Heat Recovery Units...)
- Overhead Sulphur Condensers
- Metal dusting avoidance (Syngas, Supercritical CO₂, ETC...)
- Nitric Acid Condensers

COATING FOR VANADATE ATTACK RESISTANCE IN A COKE CALCINER HEAT RECUPERATOR



Figure 1 State of the Art 2014 - Substrate AISI310

After promising results with small samples, a first batch of real size tubes has been sent for **one year** trial in a US refinery (see *Figure 2*)



Figure 2 - Tubes 6m longer coated by Kera-Coat/IK4-Cidetec

9 coated tubes with our ceramic K-100 were placed in the upper row (the hottest) of the #3 calciner recuperator on May 2015.

Oil fumes rich in vanadates are measured at 700°C (1300°F) and metal surface is estimated at 550°C (1000°F)

The situation of this heat exchanger after 10 months in operation was clearly shown in these pictures:

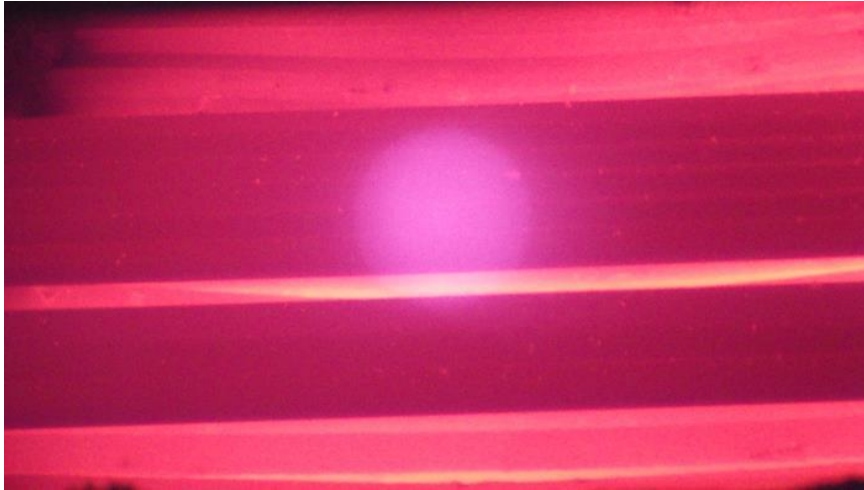


Figure 3- July 2015 (3 months working)

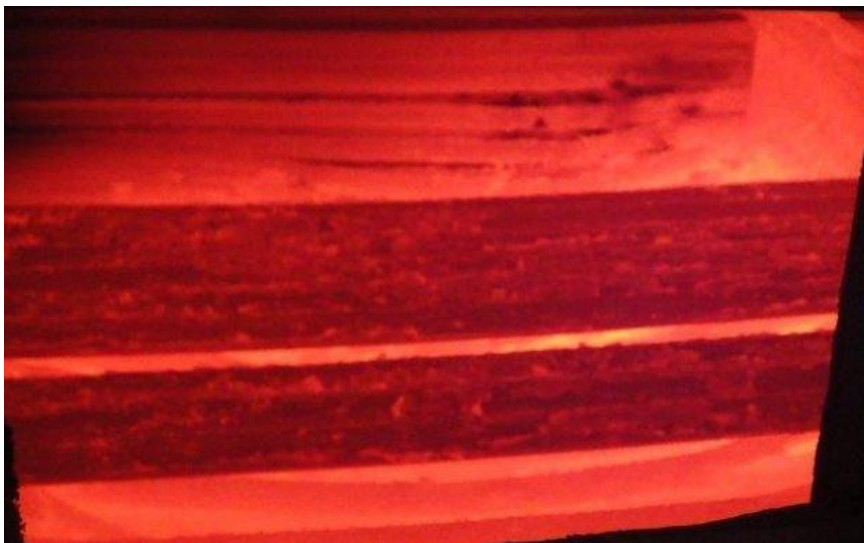


Figure 4- 2015 October (6 months working)



Figure 5 - 2016 February (10 months working)

Only the 9 coated tubes were remaining in the area, the rest were broken and blinded, so most of the passing air went thru the survives on the lower part of the exchanger

The remaining coated tubes suffered an overheating during the last weeks of operation and specially one of them that got bowed

This one was taken out beginning March 16, the rest were left in position and continue on service.

KERA-COAT is continuously researching in the direction to increase the melting point of our ceramics in order to fight degradation at higher temperatures.

A FIRST ORDER FOR FULL REPLACEMENT OF A SET OF 850 TUBES HAS JUST BEEN PLACED TO TUBACOAT

It will be assembled on site next April 17

2017.11.10 UPDATE

Last April 2017, a set of 850 tubes has just been assembled in a WASTE HEAT RECUPERATOR of a COKE CALCINER UNIT.

After 5 months operation Ceramic Coated Tubes are in perfect shape, without any damage in their surface, only some ash deposits (light points) most likely flying flakes ... as they do not seem to be making any build up on the tube "shoulders"

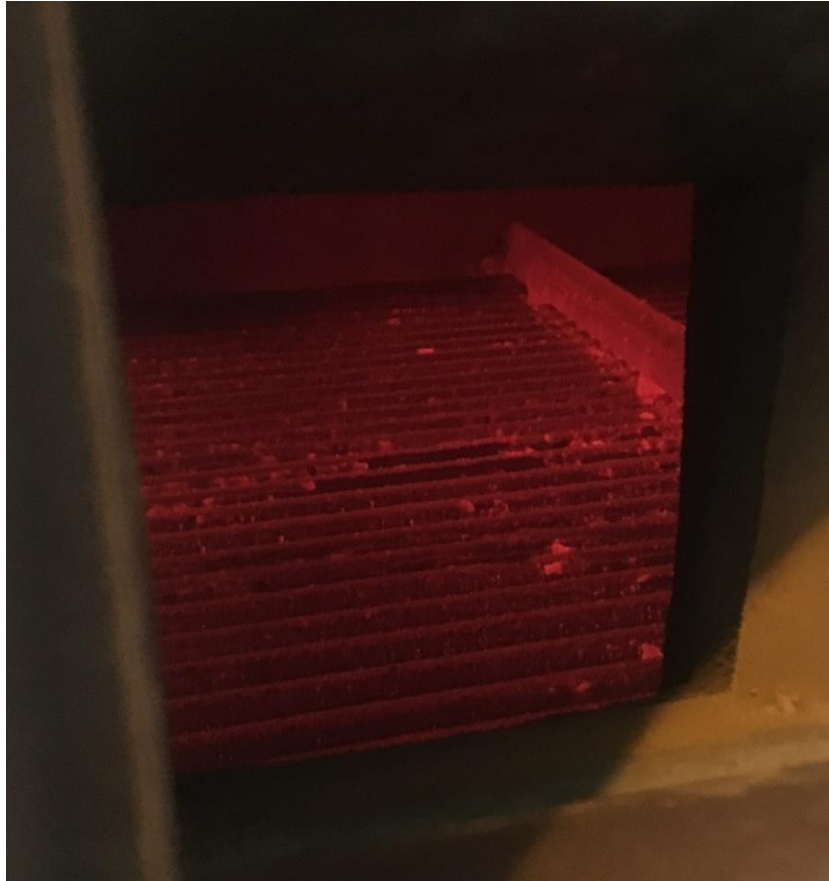


Figure 6

Comparing with the previous arrangement – in the same operational time – where only a few tubes were coated (TWO OF THEM IN THE FOREGROUND)... the difference is outstanding.

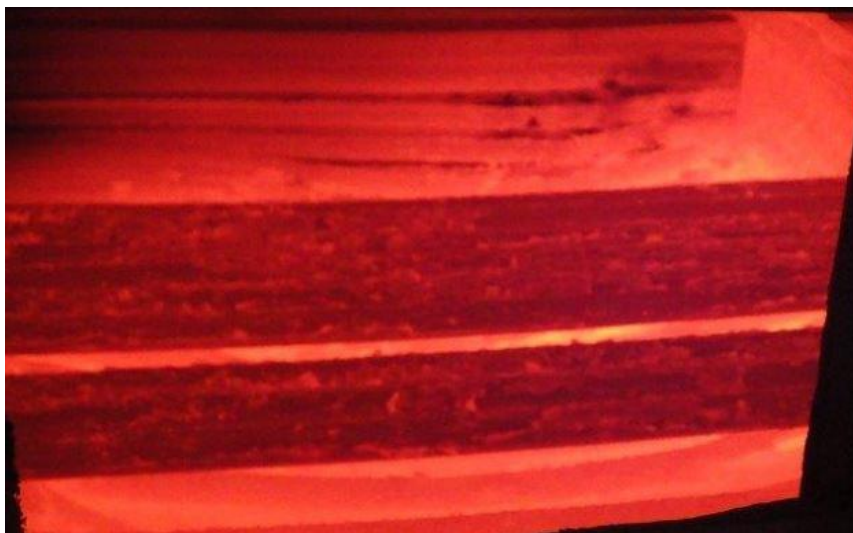


Figure 7

Last year, with only 9 scattered COATED tubes among more than 800 bare tubes, many of the last ones where so corroded that air was already leaking thru many holes in their upper “shoulder” thus overheating the tube steel and further increasing the corrosion rate

More and more air was escaping thru the open holes and ALL tubes were losing “refrigeration” and getting hotter and hotter

NEVERTHELESS ... AFTER 10 MONTHS SERVICE THE 9 COATED ONES WERE WITHOUT ANY HOLE and still fully operational

Now with the whole set of 830 coated tubes... the recuperator works as new after 5 months which previously meant the 70% of the allowed life.

2018.02.21 UPDATE

Last April 2017, a set of 850 tubes has just been assembled in a WASTE HEAT RECUPERATOR of a COKE CALCINER UNIT.

After 10 months operation Ceramic Coated Tubes are in perfect shape, without any damage in their surface, only some ash deposits (light points) most likely flying flakes ... as they do not seem to be making any build up on the tube “shoulders”

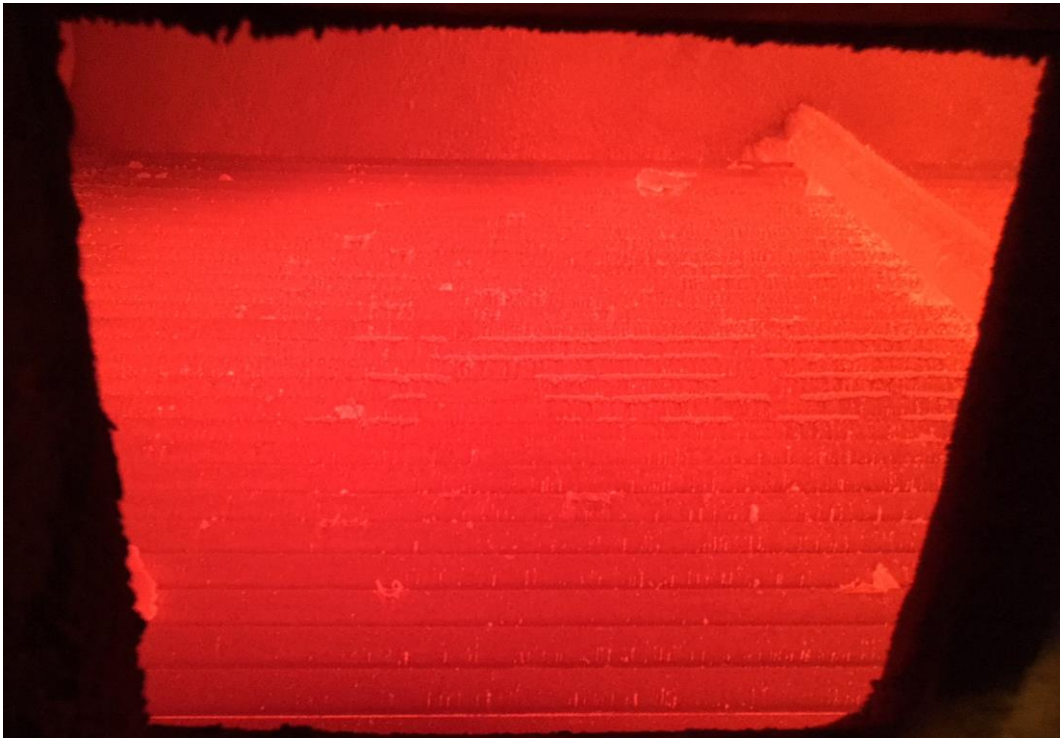


Figure 8

Comparing with the previous arrangement – in the same operational time – where only a few tubes were coated (TWO OF THEM IN THE FOREGROUND)... the difference is outstanding.



Figure 9

Last year, with only 9 scattered COATED tubes among more than 800 bare tubes, many of the last ones were so corroded that air was already leaking thru many holes in their upper "shoulder" thus overheating the tube steel and further increasing the corrosion rate

More and more air was escaping thru the open holes and ALL tubes were losing "refrigeration" and getting hotter and hotter

NEVERTHELESS ... AFTER 10 MONTHS SERVICE THE 9 COATED ONES WERE WITHOUT ANY HOLE and still fully operational

Now with the whole set of 830 coated tubes... the recuperator works as new after 10 months which previously meant the 95% of the allowed life.