Cetek COATINGS

FACILITATING THE PRODUCTION OF A HIGH-OCTANE REFORMATE

PROBLEM:

Firing with a mixture of oil and gas has resulted in excessive fouling of the radiant tubes, limiting the capacity of the fired heaters to produce a sufficiently high octane reformate.

SOLUTION:

Cetek ceramic coating presents a less reactive surface, reducing the accumulation of the fouling material.

Oil and Gas CRU Fired Heaters

The Catalytic Reformer fired heaters at a European Refinery are a combination of cabin style (Interheater #1), constructed in 1964, along with two double-fired U-Tube heaters (Charge Heater & Interheater #2).

Excessive Fouling on the Radiant Tubes

When Cetek became involved with these heaters in 2001, they were fired with a mixture of oil and gas. A consequence of the oil fuel was excessive fouling of the radiant tubes in all cells, which limited the capability to produce a sufficiently high octane reformate.

The fouling is caused by a condensation of combustion products on the radiant tube surfaces, unlike in gas-fired heaters where oxidation is the major factor.

A ceramic coating presents a less reactive surface and fouling material accumulates more slowly and does not build so thickly as with un-coated steel alloy tubes.

Absorbed Duty Improvement Achieved

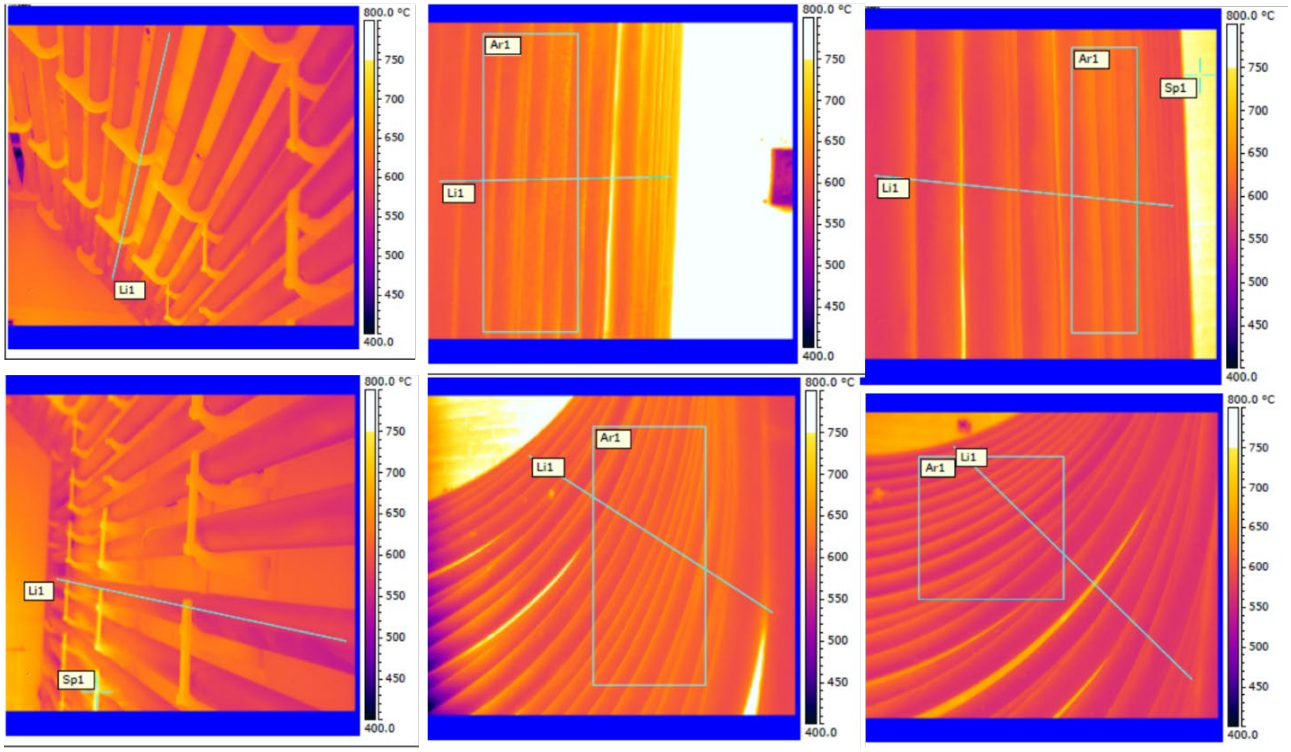
In 2001, an application of high emissivity ceramic coatings to the radiant tubes in the most badly fouled heater cells, Interheater #1 and Charge Heater was recommended.

After 5 Years in Service, 2006 Application

Before the next shutdown in 2006, the fired heaters were evaluated again and while there remained meaningful benefit from the earlier coating application, it was apparent that it would be economically prudent to re-apply the tube coatings to all the cells, including Interheater #2.

Heater Cell	Evaluated Absorbed Duty Increase	Actual Absorbed Duty Increase
Interheater #1	18.8%	18%+
Charge Heater	18.7%	18%+
Interheater #2	18.4%	28.1%

Evaluated and Actual Benefit from Tube Coating, 2006



IR Thermography following Coating Application, 2006

2011 Application

Continued firing with oil/gas fuel meant that fouling continued as before, and a third Cetek coating application was completed in 2011.

The original application of the Cetek coating allowed the refinery to increase operating severity and allow the production of a higher octane product. Repeated applications of Cetek high emissivity ceramic coatings to the radiant tube surfaces have maintained that condition through the years.

While it is apparent that fouling from oil-fired combustion cannot be eliminated without fuel and equipment changes, it has been successfully controlled by the ceramic coating application. Reduced accumulation rate and reduced thickness build have been demonstrated because of the nature of the ceramic coating surface, compared to an uncoated steel alloy

Heater Cell	Evaluated Absorbed Duty Increase	Actual Absorbed Duty Increase
Interheater #1	15.5%	27.8%
Charge Heater	20.7%	38.1%
Interheater #2	17.9%	23.9%

Evaluated and Actual Benefit from Tube Coating, 2011