Coatings for Delayed Coker Heater Tubes





Evan Hyde President



What can *C2* Technology do for Delayed Cokers?

- Extend Run Lengths
- **Stabilize Coke Formation**
- **Eliminate Metal Sulfidation**
- **Reduce Metal Carburization**
- Lower Heater Duty
- **Reduce Greenhouse Gases**
- **Extend Equipment Life**



Questions Addressed Here

- What is it?
- Does it stay bonded to the surface?
- □ Is it stable at high temperature?
- Why does it work?
- □ How is it applied?
- □ How long will it last?
- How can it be applied at your facility?





Ultra -Thin Film

Substrate Material





68	59	60	61	62	Eu	64	⁶⁵	66	67	68	69	Yb	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm		Lu
90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr



TEM Image by Dr. Jane Howe, Oak Ridge National Laboratory

6





SAM Profile by Dr. Harry Meyer, Oak Ridge National Laboratory

Strong Surface Bonding Example



Shot Sleeve (Cold Chamber)







Users







Untreated Roll, 1 Week



9

Erosion and Wear Resistance Example



10

C2 Treated Roll, 10 Weeks





Fouling And Coking Technology, Inc.

DR. GHAZ DICKAKIAN

References Include







Graph of data from fouling results





Untreated



Coke Stabilization Achieved Half-Way Through Testing







Virtually Eliminated Sulfidation



Coke Deposit

Iron Sulfide Layer Eliminated by C2 Tube Metal

Typical of 9Cr Furnace Coke Deposit







- Calculated Effectiveness of the coating in mitigating fouling effectiveness <u>60%</u>
- **C2 Stabilizes Temperature Increase**
- **C2** Retards Coke Formation
- C2 Prevents Metal Sulfidation
- C2 is Stable at Delayed Coker Furnace Operating Temperatures
- C2 does not Spall off and Contaminate the Product



Ethylene Cracker Testing at DOE's Oak Ridge Nat'l Lab





75% Less Coke Deposition





Other Petrochemical Applications:

- Hydrocrackers
- Hydrotreaters
- Reformers
- Venturi Scrubbers
- Caustic Attack
- H₂S Attack
- ... and many others

















Repeat



Application cycle 8-12 hours

Total onsite time 96 hours (max)
Includes rig in/out time & polishing
Incremental to typical pigging time



Field Application

FRONTIER OIL CORPORATION

How can you verify This technology at YOUR site ?

- Tube Segment
- Single Cell Treatment
- Whole Heater Treatment

Tube Segment

20' Tube Segment

Low Risk/High Reward Proposition, providing:

- Extend Run Lengths
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- **Reduce Metal Carburization**
- Lower Heater Duty
- **Reduce Greenhouse Gases**
- **Extend Equipment Life**

NANO DOWNTIME

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