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?



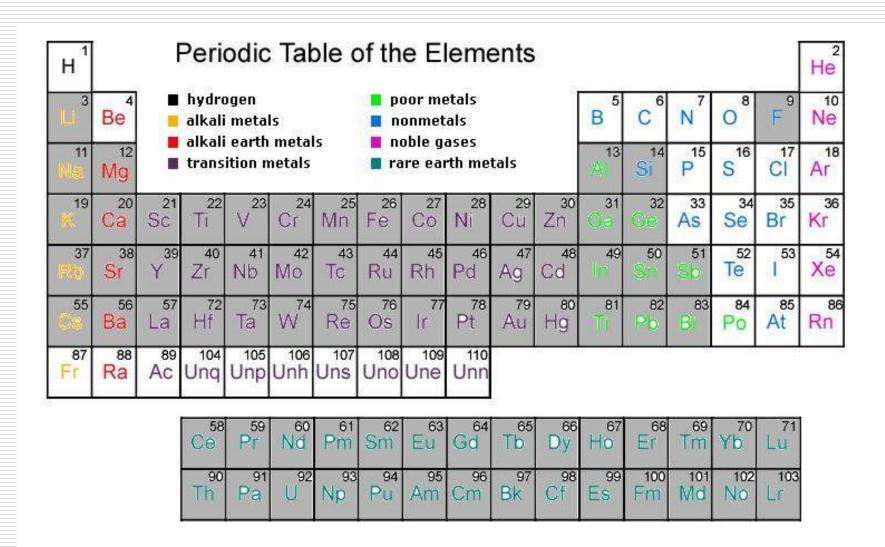
Ultra -Thin Film

Diffusion Layer

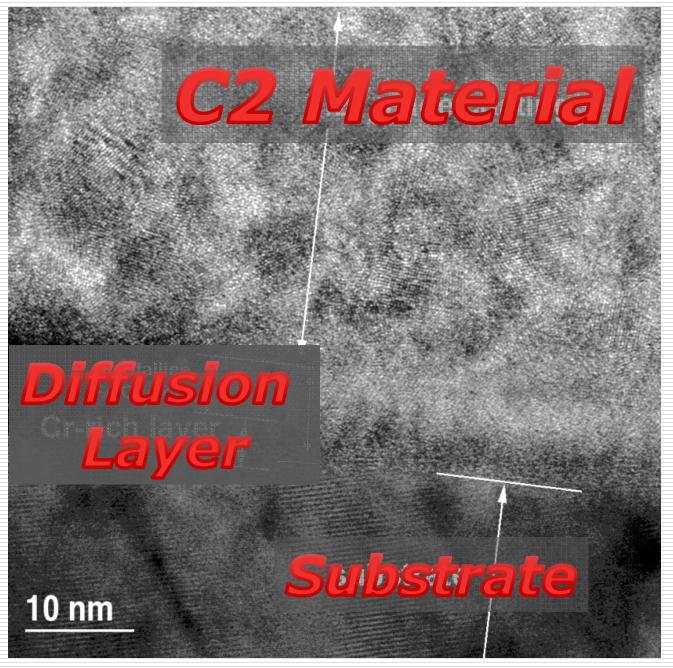


Substrate Material





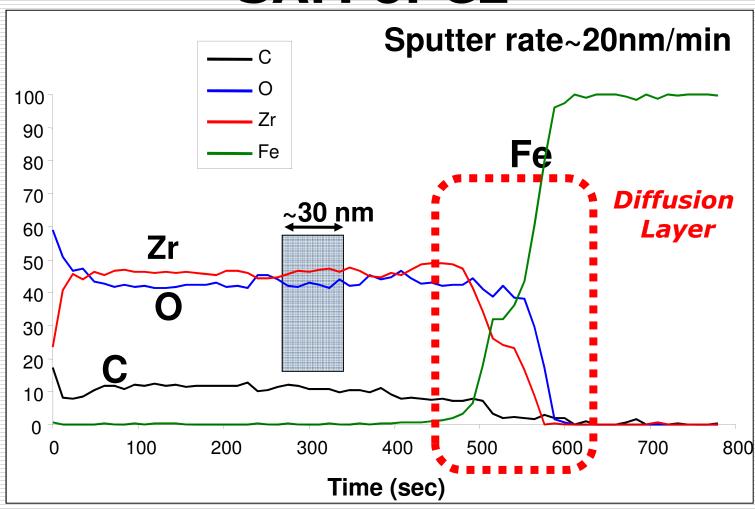




TEM Image by Dr. Jane Howe, Oak Ridge National Laboratory



SAM of C2



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



Strong Surface Bonding Example

Shot Sleeve (Cold Chamber)





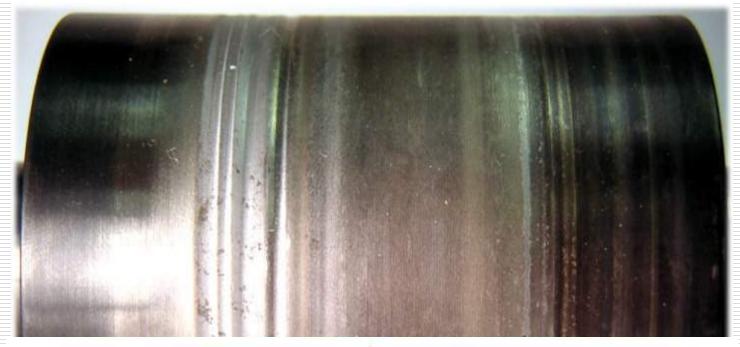


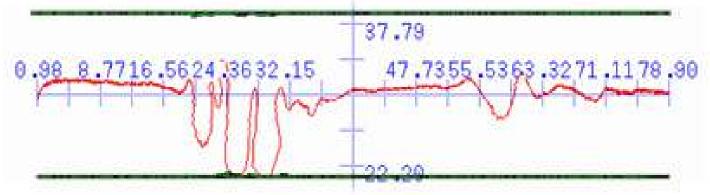




Erosion and Wear Resistance Example

Untreated Roll, 1 Week





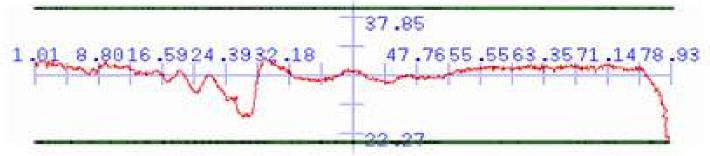


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Erosion and Wear Resistance Example

C2 Treated Roll, 10 Weeks









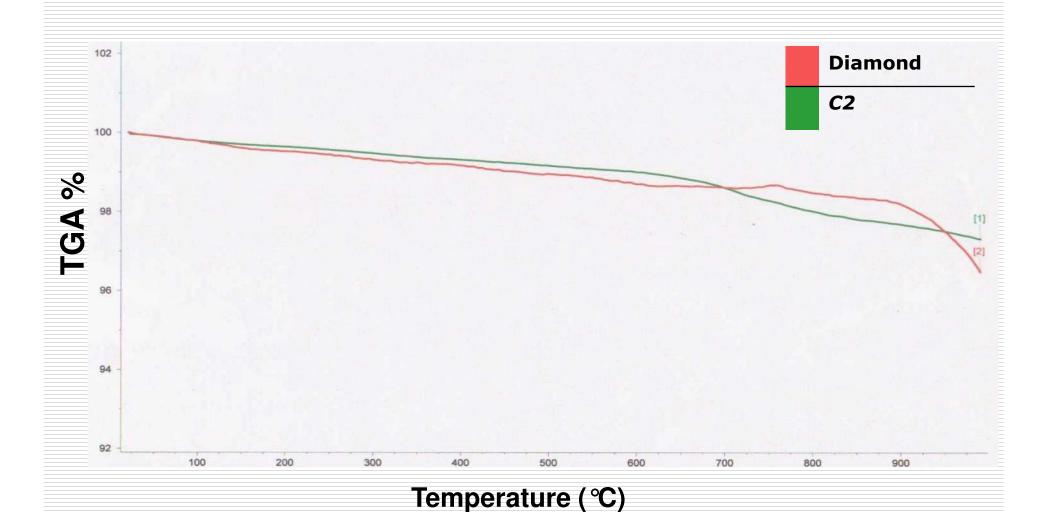
DR. GHAZ DICKAKIAN

References Include





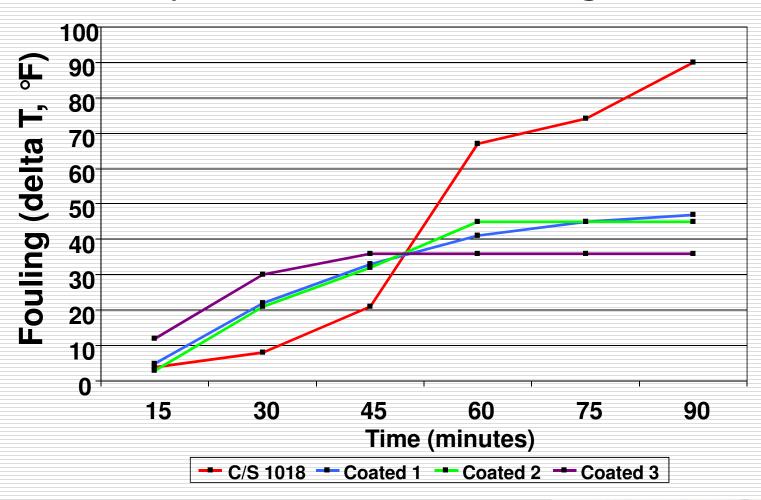
Thermogravimetric Analysis (TGA)



Fouling And Coking Technology, Inc.



Graph of data from fouling results





Untreated





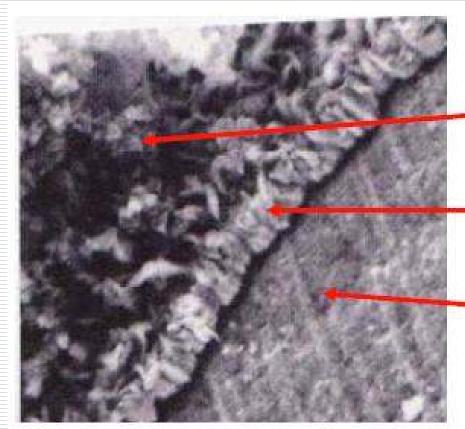
"C2" Treated

Coke Stabilization Achieved Half-Way Through Testing



NANO DOWNTIME

Virtually Eliminated Sulfidation



Typical of 9Cr Furnace Coke Deposit

Coke Deposit

Iron Sulfide Layer
Eliminated by C2

Tube Metal





- Calculated Effectiveness of the coating in mitigating fouling effectiveness 60%
- □ 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

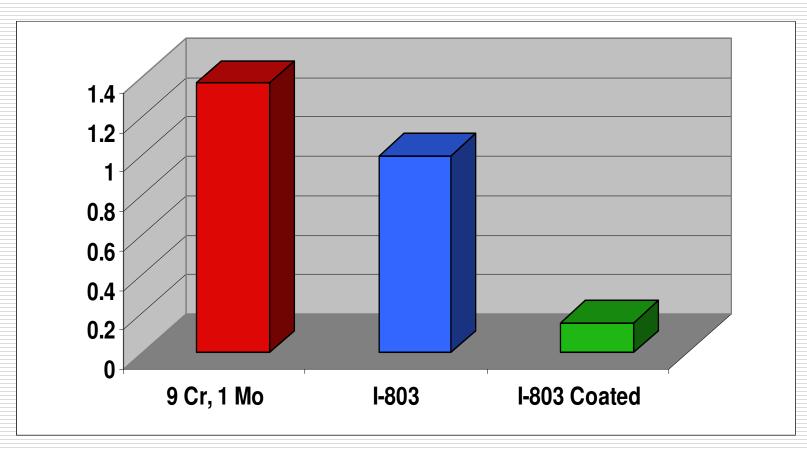


Ethylene Cracker Testing at DOE's Oak Ridge Nat'l Lab





75% Less Coke Deposition



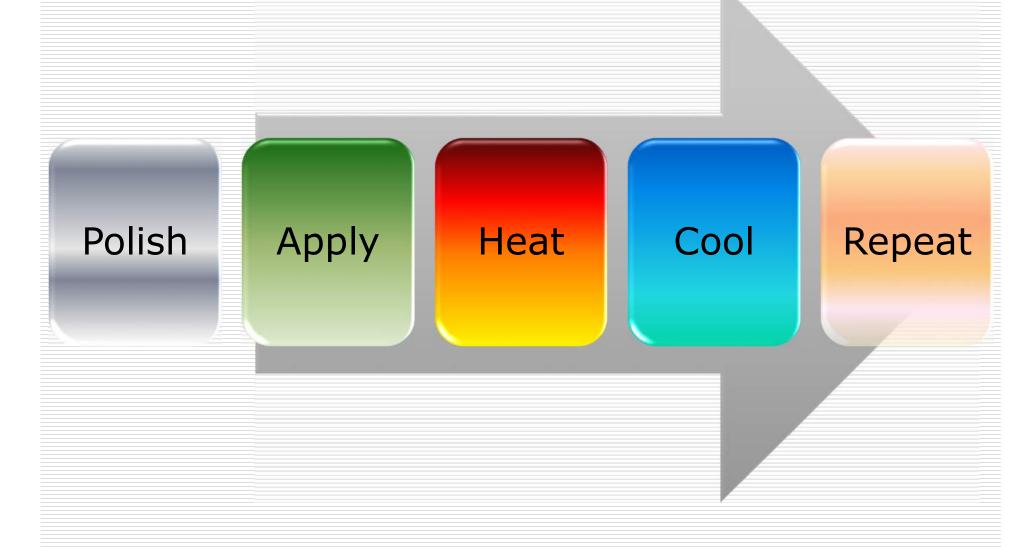
1,000 Hours at 900°C



Other Petrochemical Applications:

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

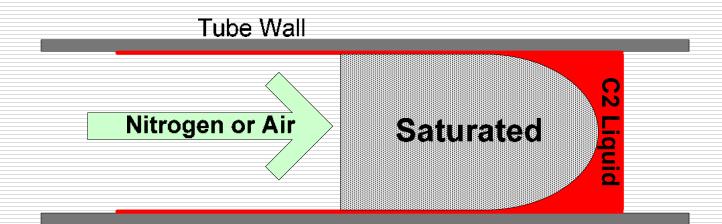




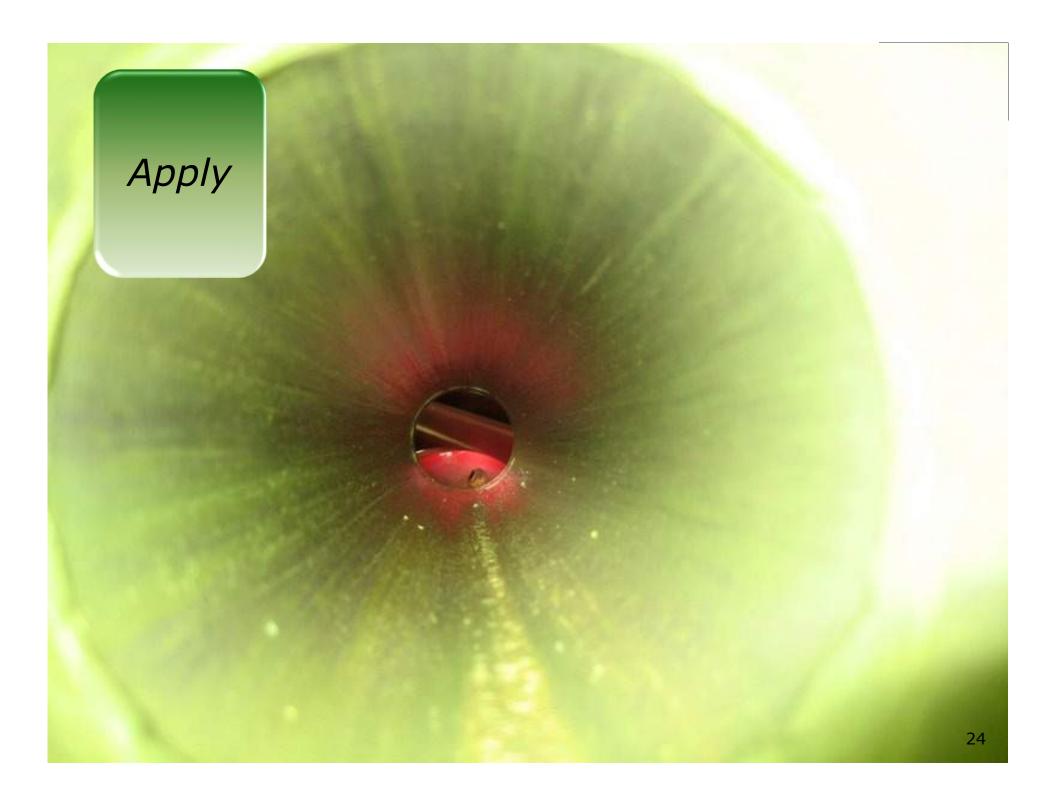




Apply













Repeat

4-6 Times

- Application cycle 8-12 hours
- Total onsite time 96 hours (max)
 - Includes rig in/out time & polishing
 - Incremental to typical pigging time



Risks





Field Application



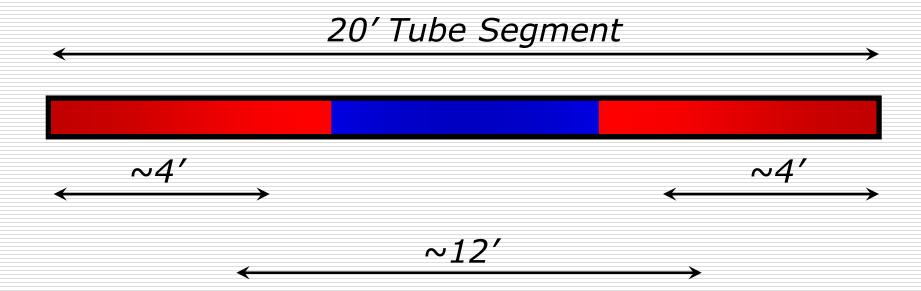


How can you verify This technology at YOUR site?

- Tube Segment
- Single Cell Treatment
- Whole Heater Treatment



Tube Segment









Low Risk/High Reward Proposition, providing:

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



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