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Catalyst Assisted Manufacture of Olefins (CAMOL)

DE-EE0005754

Lyondell Chemical/BASF Qtech

Project Period Two

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BASF The Chemical Company

quantiam technologies inc.

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

Project Background

- Coke is a naturally occurring by-product of steam cracking
- Coking (carbonaceous deposits) of the furnace coils increases energy requirements, requires frequent production interruptions to de-coke, and shortens coil life
- Both the metal surface and gas phase reactions contribute to coke formation
- Not only must metal surface be passivated, but gas phase deposits must also be removed to prevent accumulation of coke deposits
- CAMOL, a catalyst-based coating technology for furnace coil offers solution for both surface (filamentous) and gas phase cokes (manganese oxide and calcium tungstate as catalysts)

Project Objective

- Reduce energy consumption in the radiant section (furnace coils) of an ethane cracker by 15% (6% savings overall per cracking furnace)
- 10-fold improvement on standard operating run-lengths without decoking under standard cracking conditions
- Higher severity cracking mode of operation
  - Maintaining at least 50% of the minimum energy and emissions reductions

Technical Approach

- CAMOL technology was developed primarily for steam cracking of naphthas (liquid petroleum feedstocks) that produces high gas-phase coke
- Advance CAMOL technology to operate at much more severe cracking conditions required for steam cracking of ethane
- Technology required novel chemistry to anchor the catalytic coating to prevent delamination from thermal shock (furnace upsets)
- Lyondell Chemical is a top-tier global producer of ethylene, operating multiple crackers
  - Pilot testing of technology
  - Full-scale manufacturing trial
- BASF Qtech is the developer and only worldwide supplier of catalyst coating technology

Measure of Success: #1

- Ethylene is the largest chemical produced (53 billion lbs in U.S. alone (2010)) and steam cracking of ethane is the largest consumer of energy (450 Trillion BTU in U.S. (2010))

- Anticipate 6% overall energy reduction per cracking furnace
  - Equivalent effect of removing 230,000 automobiles from circulation and their associated emissions in U.S.

- Anticipated energy savings is 2.7 Trillion BTUs per year, enough to supply natural gas to over 37,000 U.S. homes

Measure of Success: #2

- Higher Productivity Crackers
  - Less coking means longer production time
  - Improved production yield

- Primary Beneficiary :
  - U.S. Chemical Industry leveraging the United States' global leadership in shale gas (ethane) production
  - U.S. ethylene producers will have a cost advantage over producers in other regions
  - Results in the creation of high-paying manufacturing jobs in the U.S.

Transition and Deployment

- After a successful commercial demonstration at Lyondell's LaPorte, TX olefins cracker, results will be shared with the DoE and with BASF Qtech who will market and produce CAMOL coatings globally

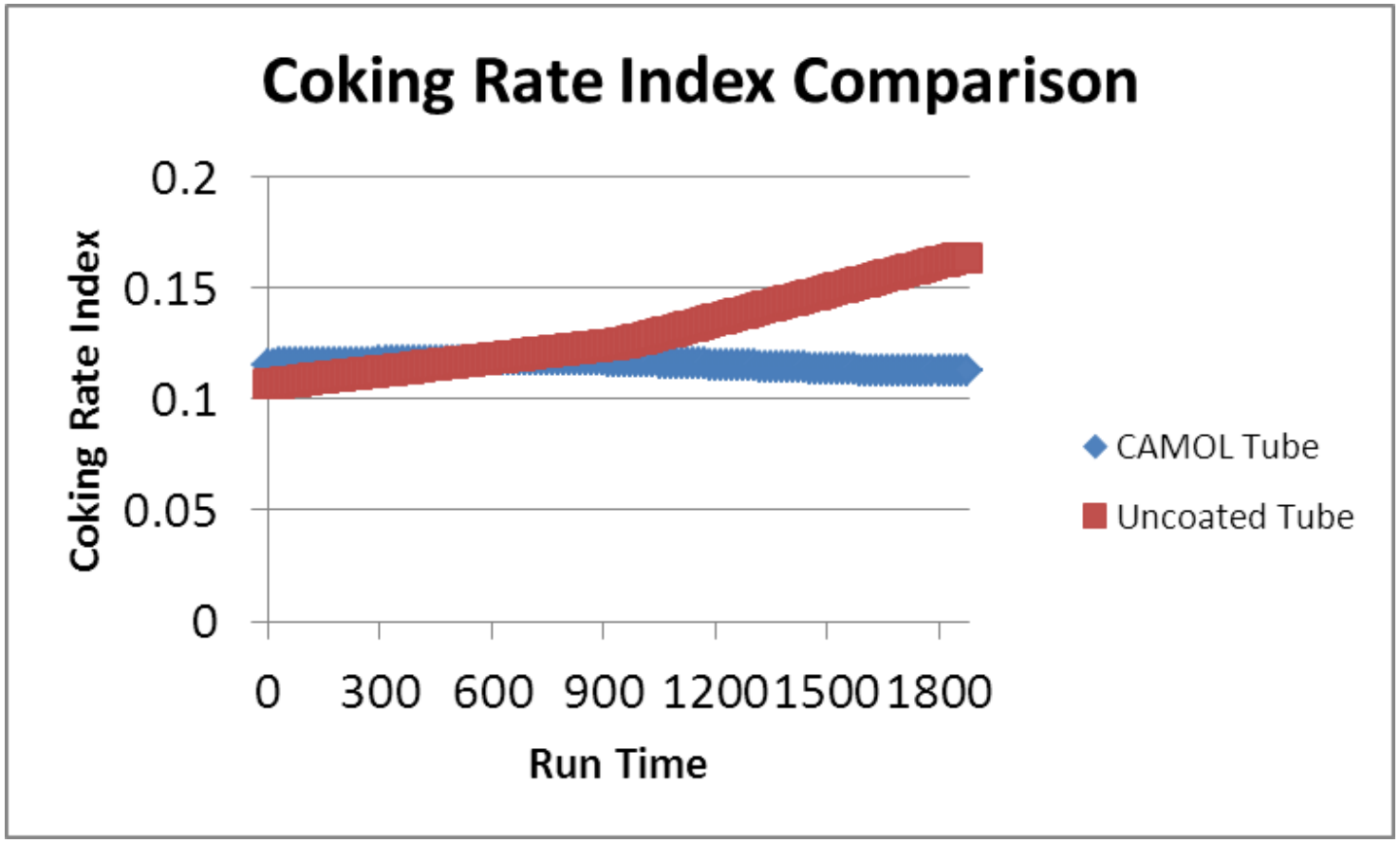
- The results will be compared to other anti-coking technologies that only reduce surface coke and their cost/benefits calculated under various ethylene manufacturing scenarios

Project Management & Budget

- The project will last three years and is in its second year.
- Project task and key milestone schedule
  - Improve robustness of CAMOL coating (completed)
  - Cast furnace tubes and ship to coater (in progress)
  - Coat furnace tubes and activate surface (pending)
  - Weld and assemble into coils (Oct-Dec 2014)
  - CAMOL Surface Generate Furnace Coils (February 2015)
  - Install coil in furnace (March 2015)
  - Monitor performance (April-September 2015)

Total Project Budget	
DOE Investment	$4,268,444
Cost Share	$2,083,751
Project Total	$6,352,195

Pilot Cracker Testing Results



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