Bench-Scale Testing for Rapid and Relevant Prediction of Crude Fouling Characteristics using the Hot Liquid Process Simulator

Crude Oil Quality Association
March 3, 2016
San Antonio, TX

Blake Branson, Ph.D.
Business Development Manager
Alcor Petrolab
INTRODUCTION

• HLPS test evolved from JFTOT test equipment in the 1980’s
• Equipment originally produced by Alcor Petroleum Instruments – now PAC (Houston, TX)
• Comparable equipment – Refinery Process Analyzer – built by Falex (Sugar Grove, IL)
• HLPS testing is a “batch-release” test required for aircraft turbine oils – SAE ARP 5996
  – Several thousand tests performed annually
• HLPS testing informs those concerned with:
  – Performance of heat exchangers
  – Performance of refinery additives
  – High-temperature processes
  – Lubricant development
HOT-LIQUID PROCESS SIMULATOR
HOT-LIQUID PROCESS SIMULATOR

Reservoir:
- ~ 900 ml capacity
- Ambient to 200°C
- 0 to 1000 psi
HOT-LIQUID PROCESS SIMULATOR

Reservoir:
- ~ 900 ml capacity
- Ambient to 200°C
- 0 to 1000 psi

Pump:
- 0.1 to 10 ml/min
- Re ~ 4
- Recirculating or “One-Shot” Plumbing Configuration
HOT-LIQUID PROCESS SIMULATOR
HOT-LIQUID PROCESS SIMULATOR
HOT-LIQUID PROCESS SIMULATOR

- **Heater Tube:**
  - Test section ~ 2” long, 1/8” OD
  - Resistively Heated
  - Max Temp ~550°C
  - 1018 Steel, 316 Stainless, or Aluminum

- **Oil Temperatures Monitored via Thermocouples**
TEST DATA – MEDIUM WT. CRUDE OIL W/O ADDITIVES

Temperature (deg C)

Tube Temp
Power
Oil In
Oil Out
TEST DATA – MEDIUM WT. CRUDE OIL W/O ADDITIVES

Temperature (deg C)

Tube Temp
Power
Oil In
Oil Out

© Alcor Petrolab
TEST DATA – MEDIUM WT. CRUDE OIL W/O ADDITIVES
TEST DATA – MEDIUM WT. CRUDE OIL WITH ADDITIVES
OTHER TESTING APPLICATIONS – “CONSTANT OIL TEMPERATURE”

- Hold Oil Out Temperature Constant
- Measure Increase in Power Requirements
OTHER TESTING APPLICATIONS – PROCESS TEMPERATURES

• Determining “Break Temperature” of Refinery Intermediates
  – Heater Tube at 550°F:

  ![Image of heater tube at 550°F]

  – Heater Tube at 475°F:

  ![Image of heater tube at 475°F]
OTHER APPLICATIONS

• Test candidate blends

• R & D Testing for Novel Coatings
  – Does a new coating reduce fouling? Increase performance of heat exchanger?
CONCLUSIONS

• Test process variables with no risk to equipment, process stream
• Rapid results
  – Expect approximately 1 – 2 tests per day
Contact Information:
Blake Branson, Ph.D.
blake.branson@alcorpetrolab.com
817-633-9119