EPC Operations Committee Meeting Minutes

Time: 1:00 - 2:00 pm
Date: 12-15-20
Location: virtual
Attendance: David Dutschmann, Jenny Heinlein, Richard Rolke, Vik Balasubramanian, Marty Shelton, Dan Euhus, Claire Cagnolatti, Miguel Maldanado, Carl Harry, Jeff Edwards, Patty Summers

Agenda;
- Anti-Trust statement - Patty
- Membership.
- Virtual conference 2021
- Paper ranking and discussion

Anti-Trust Statement:
"No activity of the Committee shall involve the exchange, collection or dissemination of information among competitors for the purpose of bringing about or attempting to bring about any understanding or agreement, written or oral, formal or informal, express or implied, among competitors with regard to costs, prices or pricing methods, terms or conditions of sale, distribution, production quotas or other limitations, on either the timing, or volume of production, or sales, or allocation of territories or customers."

Meeting Minutes:

Membership:
Mike Milanowski is now an employee of LyondellBasell and has a new email address to reflect that.

2021 Conference Papers:

The conference will be virtual. Further details will be coming as to the timing of the sessions. Seems that the deadlines for finalizing the paper selection will float until January.

We discussed that some authors may not be interested in presenting know it is now a virtual conference. The authors were sent a notice advising them to contact AICHE session chairs if no longer able. Patty will reach out to paper C as this one was uploaded without a sponsor.

Without specifics on a timeline our best guess for final presentations is first week of March 2021.

Current abstracts: (full text of abstracts at end of notes)

A. Steam Line Failure – Dow (Jenny/Richard sponsoring) LOADED
B. Combustion Air Preheating technology and associated energy savings (and CO2 reduction) – Technip (Miguel is sponsoring) LOADED
C. Promising Chemical Treatment Approach for 1,3-Butadiene Fouling (no sponsor) LOADED
D. Vertical Thermosyphon Reboiler Operation Troubleshooting – ExxonMobil (David is sponsoring) LOADED

E. Furnace Modernization: An Economical Way to Upgrade your Existing Furnace to Improve Energy Performance and reduce CO2 Emissions (no Sponsor) LOADED
F. AI application for plant operations – Vik sponsoring
G. An Experiment to Assess Crude Butadiene Recycle Capabilities – Marty sponsoring

Prior to the meeting, the group did a rough ranking. Paper G came out a bit later than the others, so not all voters included this abstract in their ranking.

The results showed:
Papers A & B were top favorites followed by papers D & E. C & F were less popular as was G (which lacked visibility).

Claire commented that perhaps some may not be interested in a butadiene topic depending upon what feeds they have been running.

Other abstract discussion:
Carl reported that he anticipates a final abstract very soon on the Operator training and its importance to producers. The team agreed this is still a very desirable topic and with the delay in finalization, we should plan to include this one.

The AI paper, (abstract F) is good but a better fit in the digital session. Richard to see if they could use papers. Vik who is the sponsor agreed this would be a good idea to move it over.

Environmental may be interested in the furnace paper (E), however, we thought best to hold on to this to be sure we have enough.

Action:

- Richard to see if digital could use paper F. He has done so. That paper will be transferred.
- Patty to contact authors of paper C to confirm participation in virtual conference.
- Patty to work with AICHE home office to get abstract G uploaded.
- Carl to follow the abstract for the Operator paper and send to the committee when ready.
- Dan/Richard/Jeff to inform team when updates are available on the details of the virtual meeting.
- Patty to confirm timeline for submittal of presentations and papers.

Next Meeting:

Full Abstracts

***Paper A*---**

Abstract id# 618961

Steam Blow Line Split – Cause, Corrections, and Recommendations

Ryan Johnson, Dow Chemical Company, Freeport, TX

Abstract Text:

Standard industrial practice for cleaning steam circuits is the use of a low-pressure continuous steam blow, where a steam flow is controlled at conditions defined to create pipe wall forces above what is expected under normal operation. The steam control is commonly accomplished with the use of an orifice plate or a ‘sacrificial’ valve. During the 2017 commissioning of an ethylene production facility in Freeport, Texas a steam line failed and split open while performing a low-pressure continuous steam blow. This paper discusses the details of the failed steam blow, the cause of failure (line irregularities, acoustic induced vibration), and the leverageable corrections made to effectively and safely re-establish and complete the steam blow.

Paper B---

Abstract id# 618819

Energy Saving for Steam Cracking Furnaces By Combustion Air Preheating Technology

Fanxu Meng[1], Yong Wang[1], Miguel Maldonado[1], Joel Guillaume[1], Mingwei Shi[2], Songlin Shao[2], Xiaofeng Li[2], Xiaofeng Song[2] and Yue Liu[2], (1)TechnipFMC, Houston, TX, (2)Beijing Aerospace Petrochemical EC and EP Technology Corporation Limited (BAEEC), Beijing, China

Abstract Text:

Cracking furnace energy saving is in the major interest of ethylene plants and petrochemical companies. Combustion air preheating technology for the ethylene cracking furnace burners allows for the recovery of some of the low-level waste heat rejected in the furnace effluent stream. Effective recovery of this low-level heat is challenging because its quality is not high enough to be effectively utilized otherwise and is usually removed by cooling water.

This patented combustion air preheating technology is a high-efficiency heat transfer technology. It is designed based on fully mastering of the furnace operation, the plant heat balance, and the innovative experimental research on furnace. This technology utilizes low-level heat sources, such as low-pressure steam (150 ~ 200 ℃), quench water (60 ~ 90 ℃), and low-pressure condensate (100 ~ 200 ℃), to pre-heat the combustion air to the cracking furnaces, thus reducing total firing duty. As the fuel gas consumption is reduced, less flue gas emission is released to environment. Operation of the built piping network is smooth and does not require additional equipment consuming energy (such as pressurized water pump, induced or forced draft fan, motor, etc.). The built system does not require any automatic control system. Preheater of each burner can be easily switched on and off. The combustion air preheater needs only simple maintenance and its working life is more than 15 years. By 2020, this technology has been applied to 308 ethylene cracking furnaces and other negative-pressure heating furnaces in revamp and grassroot plants in China. It has proven its economic benefit, emission reduction, and flexible and reliable operation.

This paper discusses the fundamentals of the combustion air preheating technology. According to practical experience over many years, the energy saving of adding combustion air preheating system can be significant. Improved energy saving is generally achieved with low-level waste heat at higher temperature. The normal

operation of cracking furnace is not substantially affected after air preheaters are added. Case studies will demonstrate the cracking furnace thermal efficiency improvement, fuel reduction benefit, and design features for each project based on the individual heat sources and site conditions.

Paper C---

Abstract id# 619003

Promising Chemical Treatment Approach for 1,3-Butadiene Fouling

Henrique Silva[1], Tatiana Barbosa[2], Fabio Rios[3] and Williane Carneiro[3], (1)Customer Application Engineering, SUEZ Water Technologies & Solutions, Salvador, Bahia, Brazil, (2)SUEZ Water Technologies & Solutions, Camacari, Brazil, (3)Braskem S. A., Camacari, Brazil

Abstract Text:

At Braskem’s Camaçari site, in a Nippon Zeon design plant, 1,3-butadiene is produced by extractive distillation with dimethylformamide (DMF) used as solvent. Since longer campaigns have been desired, the treatment of the extraction section has become more challenging, especially due to its historical issues with widespread polymerization at the bottoms of extractive towers.

This paper recaps the general mechanisms involving fouling on butadiene extraction and how SUEZ and Braskem are working together to control severe fouling on the system with a promising inhibition chemical program currently used. Then some positive preliminaries results will be shown.

This process is featured by high temperature at the bottoms of the extractive distillation towers. Hence, this environment is severe enough to easily foul rubber and sheet forms of polybutadiene on economizers, reboilers and on tower’s chimney trays. OH-TEMPO chemical additive is commonly used in this system with the function of inhibit this phenomenon, but for large runs purposes this approach may be not enough. To improve inhibition efficiency, a new synergic blend of OH-TEMPO with a specific antioxidant has been used covering critical areas of the process and responding better than the previous chemical used.

Paper D---

Abstract id# 619010

Vertical Thermosyphon Reboiler Operation Troubleshooting

Carolyn Granade, Manufacturing, ExxonMobil Chemical, Baton Rouge, LA and David Dutschmann, Baytown Olefins Plant, Exxon Mobil Chemical, Baytown, TX

Abstract Text:

Vertical thermosyphon reboiler stall can result in a loss of duty and/or a loss of unit capacity. The cryogenic demethanizer reboiler is susceptible to stall during transient or turndown operation, typically resulting from a relatively wide boiling range of the tower bottoms composition and a relatively small difference between the reboiler’s inlet and outlet densities. This paper will discuss methods for correctly identifying a reboiler

performance problem as stall, and will examine and share field techniques for un-stalling a reboiler.

Paper E---

Abstract id# 619007

Furnace Modernization: An Economical Way to Upgrade Your Existing Furnace to Improve Energy Performance and Reduce CO2 Emissions

Patrick Kers[1], Jeroen Goossens[2] and Wilco Voogdt[2], (1)Technip FMC, Zoetermeer, Netherlands, (2)Shell Global Solutions International, Amsterdam, Netherlands

Abstract Text:

Shell is investing in a large multi-year furnace upgrade project whilst remaining on full production, resulting in a significant decrease of energy use and CO_2 emissions.

Shell investigated several options to maintain security of the production capacity of its 16 cracking furnaces after 50 years of operation, at its Moerdijk petrochemicals complex in the Netherlands. Following the outcome of a study, the selected options to choose from were a one-to-one replacement of 16 existing furnaces or upgrading 8 of those furnaces by doubling their capacity.

After detailed evaluation it became clear that the modernization of 8 furnaces was the most optimum path forward. Key drivers for selecting this option were:

- Improve energy performance and emissions
- Reduce environmental footprint (about 10% CO_2 reduction of Moerdijk's annual total), an important step to the Shell energy transition targets of being net carbon neutral in 2050 or earlier in step with society.
- Further process safety improvements
- Fast implementation within 5 years, without impacting production
- Lower investment cost compared to green field investment

The main process design challenge on this project is doubling the furnace capacity and improving on overall efficiency while re-using the existing firebox and burners, and maintaining existing foundations. The main project execution challenge is implementing these revamps outside of a plant turnaround to minimize the impact on the Shell Moerdijk lower olefins production, without any concessions to safety in the running plant.

This paper describes the furnace revamp design and the revamp execution strategy that minimizes field labour on site and maximises a modular approach.

Shell's technological know-how, project execution and operational experience combined with TechnipFMC's Process Technology and EPC capabilities has led to the current furnace design, enabling a 100% capacity increase within the same firebox.

Paper F---

- **Imubit abstract submission – Innovation category**

As demand for plastics and petrochemical derivatives continues to grow, plants are pushing towards true ethylene production capacities and maximized efficiencies. The

non-linear production process that supplies ethylene to downstream plants is complex and a slow dynamic process that strives to meet production goals and optimize product specifications, such as yields, purity, product slippage and pushing rates.

- A typical target for polymer-grade ethylene is 99.9% purity, with the main impurities being ethane and propane respectively. Coordination and control of many variables (feed rates, feed quality, tower loading, reflux rates, temperatures, etc.) is important for operations. These variables are constantly changing and being disturbed, which then requires an appropriate control response to maximize profitability of the fractionation towers. A major challenge is developing a model that can accurately pair both fast dynamic and slow dynamic processes coherently.
- Imubit's solution – Deep Learning Process Control® (DLPC) – helps ethylene manufacturing leaders break through these complex optimization challenges by enabling closed loop economic modelling and truly dynamic process optimization to accurately predict and set optimal target points.
- Using years of historical data, passively extracted, DLPC learns, predicts, and controls the ethylene production process to optimize product yields based on real-time economics.DLPC accounts for a myriad of non-linearalities and variables, such as changing feedstocks, multiple furnace operations, coking in furnaces, differential pressures, reflux rates, product quality specifications, market economics, operational and environmental constraints.

Paper F---

An Experiment to Assess Crude Butadiene Recycle Capabilities

Crude butadiene is a byproduct formed in the steam-cracking process. The material is normally stored and shipped out to a single customer; however, this customer has faced challenging conditions in recent years that have intermittently reduced the volume of material that they are able to receive. One way to prevent crude butadiene inventory from building up on-site is by re-routing the product stream back into the furnaces and co-cracking it with propane. This practice had never been previously tested at this location. In this experiment, the facilities were adapted to allow for re-routing the product flow and crude butadiene was successfully recycled to the furnaces for seven days. The data, observations, and lessons learned from this experiment will be used for campaigning the crude butadiene product flow in the future should the need arise due to limitations in export capacity or economic conditions.