A cost saving environmentally efficient industrial innovation forged through cooperation

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CABB

Rocsole

THE CHALLENGE

To accurately monitor reactor vessel phase boundary level in a decantation process of organic fine chemicals.

THE PLAYERS

CABB

Globally active manufacturer of fine chemicals and customised products based in Germany, with around 1,000 employees and plants in four countries.

Rocsole

Developer of tomographic imaging monitoring solutions able to see inside process pipes and tanks.

THE INNOVATION

In collaboration with CABB, Rocsole developed a tomographic monitoring system that images the reactor vessel phase boundary in the outlet pipe live during the decantation.

EMULSION WATCH

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failures in phase separation during decantation

INACCURATE MONITORING MEANS HIGH LOSSES

Due to inaccurate phase boundary measurement product may leak into the wastewater during the emptying of the reactor, which causes losses in production and increase in wastewater treatment costs.

WHY DECANTATION MONITORING IS DIFFICULT?

Liquid flow is monitored by a conductivity probe and human eye through a pipe sight glass. Flow is controlled with a hand valve. Flow is stopped when the conductivity probe measures major conductivity change or human eye notices from sight glass color change. Usually phases have some color difference, but not in all cases.

Salt from water can sometimes precipitate on top of the conductivity probe, which causes errors in conductivity measurement. At the same time color difference monitoring with human eye can be difficult due to minor color difference and can therefore lead to human error. Due to this and unreliable conductivity measurement decantation can rarely be fully automized.

In addition, bottom phase liquid velocity in reactor bottom can be too high. This leads to vortex, or in other words, a tunneling effect inside the reactor vessel. There has been no way to prove, monitor or control this phenomenon.

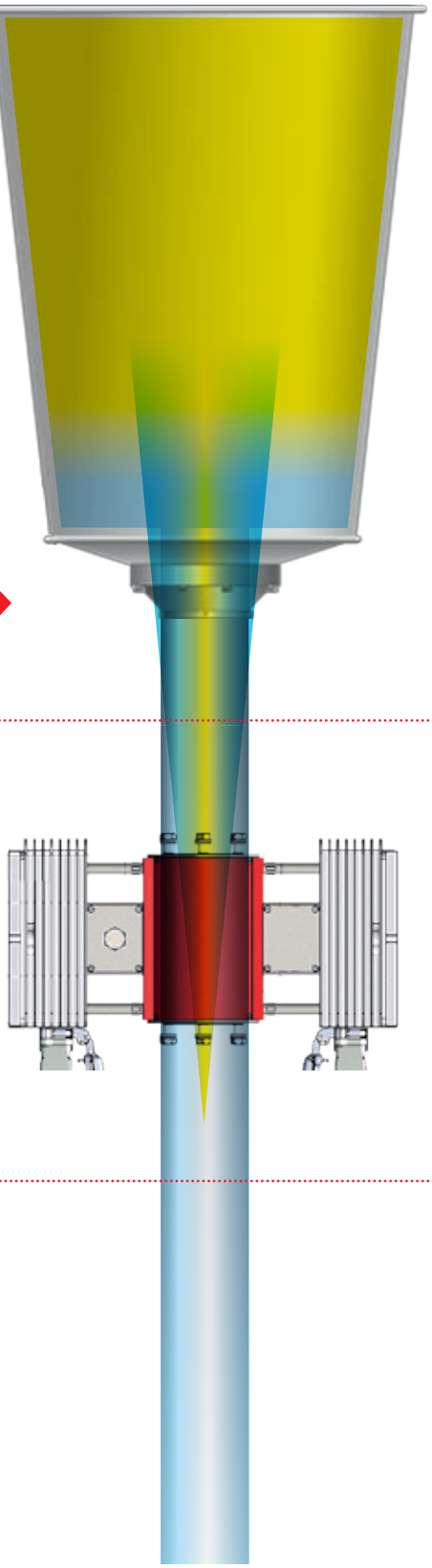
THE SOLUTION

Emulsion Watch utilizes a pipe sensor that is attached to the outlet pipe. In addition to phase boundary monitoring, the system images the pipe cross-sectionally, providing information about the vortex effect.

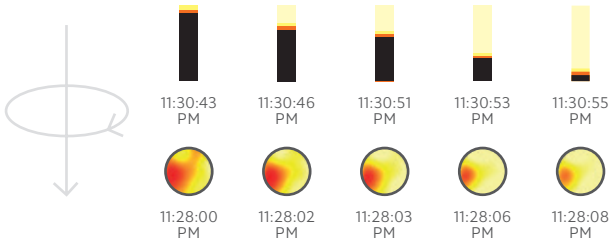
The measurement is based on electrical capacitance tomography (ECT), a non-nuclear imaging technique that can be used for the determination of the permittivity and conductivity distribution of medium, within a region of interest. The technology also enables the system to function even if the sensor is contaminated.

PHASE BOUNDARY

VORTEX EFFECT



EMULSION WATCH



DECANTATION PROCESS

In this case decantation is a batch type process done in a reactor vessel after chemical reaction and liquid-liquid extraction from mixture of two immiscible liquids. When reactor agitator is stopped, more dense liquid (water) settles to bottom phase. A lighter phase (product) separates to a top phase. When phase separation from reactor vessel starts, the reactor bottom valve opens first and then the bottom phase starts to flow.

HOW IT ALL HAPPENED

OCTOBER 12, 2013

PHONE CALL

Sami from CABB receives a phone call from a lady*

* The lady is Liisa from MarketStep, a service provider promoting new products and innovation into new markets.

Lady:

"We have a solution that images and monitors buildup inside pipes and tanks. Would you be interested in learning about it?"

rocsole

INITIAL INTEREST

Sami is interested in new technologies and thinks being able to see inside process pipes and tanks might be something great for the industry.

Sami:

"Yes please, send me more information."

CABB

NOVEMBER 12, 2013

FIRST MEETING AND THE DEMO

Pasi from Rocsole called Sami and agreed to meet up.
Pasi arrived to CABB Kokkola with a demo pipe sensor.

Pasi:

"See, when I put this paper inside the sensor, the system images it online and monitors how much free space there is left in the pipe"

Rocsole

Sami:

"I want to test the demo and put this marker inside as well.
– Wow, it really works!"

CABB

SOLUTION IDEA

Sami gets interested as there is always need for improvement in product quality, safety and the production optimization.

Sami:

"Listen Pasi. We have a need to see reactor vessel phase boundary in a decantation process. The current monitoring system is not accurate. However, we would need a full imaging of decantation process. This means that you should modify the system not only to have the cross-section eyes to the reactor vessel outlet pipe, but also provide a vertical image of the pipe with a distance of 20 cm in order to monitor the phase boundary. And the system has to be ATEX approved."

CABB

NOVEMBER 13, 2014

SOLUTION DEVELOPMENT

After analyzing and identifying CABB's needs on imaging the decantation process, not only cross-sectionally but vertically as well, Pasi takes the idea back to the office and discusses the possibilities with Arto Voutilainen – Rocsole's technology wizard.

Pasi:

"Arto, CABB has a need for an application imaging the pipe from both, cross sectionally and vertically along the pipe. I know it's complicated, but what do you think? We should be able to connect two systems run them in parallel, right?"

Rocsole

Arto:

"Well, as you said, it certainly is complicated. Not impossible, but perhaps not necessarily reasonable at this point."

Rocsole

Pasi:

"Ok, I will inform CABB we will get back to them as soon as we have the ATEX approval."

Rocsole

MARCH 3, 2015

RETHINKING

Two months later Pasi, Arto and Rocsole's tomographic team start to change their mind.

Pasi & Arto:

"Maybe we should do this now. The system requested by CABB actually is very close to a deposition measurement and there is a real customer need for the system. However, there are risks: Would there be a possibility to get a needed ATEX for this type of a system and how would the application work in the real decantation process?"

Rocsole

APRIL 2015

DECISION TO GO

After evaluating the risks, Pasi, Arto and the Rocsole tomography team decide it would be worth to develop the application requested by CABB. Pasi gives Sami a call and proposes a pilot project. Sami likes the idea.

Sami:

"Ok, let's pilot the application."

CABB

APRIL - JULY 2015

DESIGN

In order to secure a smooth start for the project, two Rocsole's engineers visit the CABB factory in May 2014. This is crucial in order to understand the type of equipment needed. Several clarifications are made and after that, mechanics of the system is designed.

MANUFACTURING

Manufacturing the system is pretty straightforward. The needed mechanical parts are machined and assembled. ATEX-approval, electronics and software design is known to take some time. This waiting time is used to improve the system's mechanical details, for example, securing the system's capability to handle 150°C cleaning temperature.

JUNE 2015

ATEX/IECEx APPROVAL

ATEX/IECEx certification is received in June 2015 for zone 0 which is the highest possible class of the certification. This actually is a real achievement, since the tomographic system is a complex piece of electronics.

COMMISSIONING

Finally, it is time to commission the system. In order to secure all the details, two electronics engineers, one software-specialist and one supervisor, are available at the site. This is clearly a case of over resourcing, but anyway, the application is new and several unexpected things may pop out. However, commissioning goes smoothly. Only some fine-tuning needs to be performed and the system sees the water separation and the void fraction very well right from the beginning.

Sami:

"The vertical image really shows the reactor vessel phase boundary. The cross-section image also indicates that some of the product is tunneling to the water while the water is pumped out from the tank."

CABB

THE RESULTS

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Failures in phase separation during decantation.

EMULSION WATCH FACTUAL BENEFITS

- Increased end product recovery
- Decreased wastewater treatment costs
- Improved product quality

Due to accurate phase boundary monitoring, CABB is now able to accurately separate the end product from water during the decantation process.

STATEMENTS

SAMI HEIKKINEN
Plant Service Manager - CABB

Emulsion Watch offers, after a long time, a complete new approach to process monitoring. Before there has not been a solution for reliably monitor the phase boundary in decantation process and monitoring of vortex effect has not been possible at all.

I believe Emulsion Watch technology has great potential to become the next breakthrough within the field of process monitoring. CABB's goal is to remain as the forerunner of chemical industry in order to offer our customers the best possible chemical solutions. That is why we want to be involved in the development of new generation process monitoring solutions such as Emulsion Watch.

PASI LAAKKONEN
CEO / Solution visionary,
Rocsole

Co-operation with CABB has been very beneficial for the development of our technology. By co-operating with such an innovation oriented company and people within it, we have been able to develop the product to fit the real customer needs. Therefore, offer the customer maximum benefits.

ARTO VOUTILAINEN
CTO / Technology wizard,
leader of the Rocsole tomography team

This project has been a great achievement for our tomography team. At first, the process monitoring challenge of the customer seemed difficult, but together with the customer and the sales team we were able to develop solution that delivers the customer real and measurable value.

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