APPLICATION REPORT

MONITORING OF WAX BUILT-UP IN ETHYLENE PIPELINES

Petrochemical Industry

"Our non-intrusive measuring technology allowed our customer to increase the operational safety of the plant without any impact on its availability."

David Imbs,
Field Sales Engineer, Flexim France

Measuring Task

Non-intrusive flow measurement of high pressure ethylene gas and simultaneous monitoring of wax deposit forming in the pipeline

With an annual overall production of over 100 million tonnes, polyethylene (PE) is the most common plastic in use today. PE is produced through polymerization of ethylene (C2H4) which is most commonly won by steam cracking. Its physical properties mainly depend on the molecular weight and the quantity of side branches. High-density polyethylene (HDPE) is produced in a low pressure catalytic process and consists of mainly linear polymer molecules. Low-density polyethylene (LDPE) has a high degree of short- and long-chain branching. It is produced in a high pressure process without a catalyst.

Due to the challenging process conditions with pressures up to 40,000 psi, constructing engineers and operators of many LDPE plants worldwide have had identified Flexim 's non-intrusive ultrasonic technology as ideal solution for flow measurements in the production of LDPE. As the clamp-on transducers are mounted onto the outside of the pipe, they are not exposed to the extreme pressure and therefore do not suffer from wear and tear. Furthermore, they do not cause any pressure loss. Another advantage of the acoustic flow measurement is its extreme high dynamic measuring range.

The operators of a French LDPE plant use the non-intrusive measuring technology also for monitoring purposes.

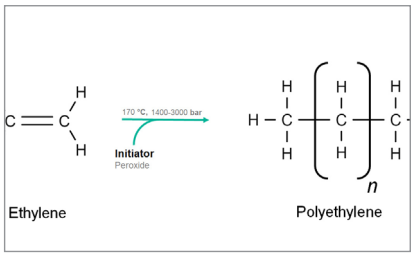
In recent years, the wax separation unit has been repeatedly damaged by fires, causing high production losses through long shutdowns and high costs for repair. The process engineers believe that the fires are propagated due to wax formation on the internal walls of the pipes. In order to minimize the risk of a future fire spreading via this vector, a regular cleaning protocol has been put in place. In addition, a project was started in order to find an appropriate instrumentation to monitor the fouling in three pipes.

Solution

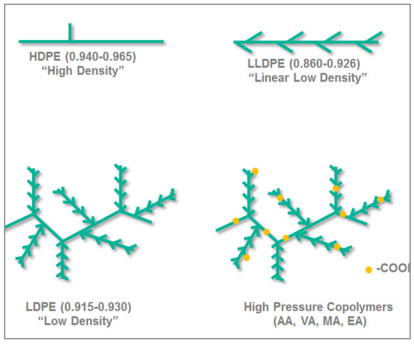
TAs the plant operators have had already made good experiences with the clamp-on ultrasonic flowmeter systems FLUXUS®, they asked Flexim France for counsel and support.

Also the clamp-on transducers are considered to measure from the safe side, i.e. the outside of the pipe, this application represented a real challenge. The difficulties here lie in the elevated temperatures, the pipe geometry with a relatively small diameter, but important wall thickness and the high flow velocities. In the regarding process stage, the ethylene has a temperature of up to 230 °F, the pressure is about 3,600 psi. Despite this pressure, the circulating ethylene has a relatively low density due to the high temperature. Therefore, only a small portion of the generated acoustic signals are emitted into the medium. A very large portion of it propagates through the 0.6" strong pipe wall as signal correlated noise. In order to achieve a reliable measurement, this noise must be effectively reduced. Unfortunately, Flexim 's standard elastomer damping mats only withstand temperatures up to 160 °F.

In the context of its research on non-intrusive steam flow measurement, Flexim has developed a new damping material which can be applied at largely higher temperatures. For Flexim France, this was the first on-site test with the new damping material. A full success! After an extensive equipment validation campaign, the operators decided to equip three ethylene lines with ultrasonic flow measuring points. As the respective ethylene lines are located very close to each other, two measuring points could be equipped with one FLUXUS® G809 dual-channel transmitter. As a result, the operators now dispose over reliable flow control in this critical process step through which they can simultaneously monitor the progressive wax formation in the pipes.



PE is produced through a polymerisation of ethylene.



Types of Polyethylene

Two measuring points with the clamp-on ultrasonic transducers mounted in Variofix C

A dual-channel FLUXUS® G809 is used for simultaneous flow measurement on two pipes. Both transducers and transmitters are installed in hazardous area classified ATEX zone 1.

Measuring Points and Instrumentation

Pipelines	Carbon steel, 3.5“ OD, wall thickness 0.6“
Medium	Ethylene gas
Measuring Devices	2 stationary clamp-on ultrasonic FLUXUS® G801 and G809 (dual channel) flowmeters for ATEX zone 1 3 pairs of clamp-on ultrasonic transducers type GRH (Lamb wave), each installed in Variofix C transducer mountings

Advantages

- Cost-effective measuring solution due to non-intrusive technology
- Effective increase of the operational safety
- Permanently reliable flow measurement without wear or even risk of clogging due to wax content in the fluid
- Excellent support through the sales and service team of Flexim France

For more information, visit
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