APPLICATION REPORT

HIGH TEMPERATURE FLOW MEASUREMENT OF POLYAMIDE 12

Chemical Industry

"After we were able to quickly resume production of polyamide 12 by bridging the defective Coriolis flowmeters, non-intrusive clamp-on ultrasonic technology also proved to be a superior measurement solution in the long term."

Dr. Karsten Hoeland,
EMR System Engineer, Evonik.

Part of the PA12 plant complex in Marl
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Measuring Task

Non-intrusive flow measurement of polyamide 12 at temperatures of around 540 °F

When plastics are exposed to particularly high loads, polyamide 12 from Evonik is used: in oil and gas production, in the automotive industry, in medical technology and in 3D printing.

Evonik developed polyamide 12 and is the world's leading supplier of this high-performance plastic. Since the first production plant for polyamide 12 was put into operation in 1966 in Marl, Evonik has continuously developed and optimized the production process. What is unique worldwide is that Evonik takes on all stages of the production process: The hydrocarbon compound butadiene is made at the beginning. The output component, the monomer laurolactam, is created in several steps. If many of these components are connected, they become a chain: the base polymer polyamide 12.

Evonik produces polyamide 12 in two forms: as granules under the VESTAMID® brand and as powder under the VESTOSINT® brand. Accordingly, the product stream of the base polymer behind the polymerization reactor is divided into two sub-streams. Coriolis

flowmeters were installed in both for quantity measurement. In view of the process conditions, however, the wetted measuring technology has serious disadvantages: The melting temperature of polymer is around 360 °F, so the product stream must be heated continuously. Reliable heating of the Coriolis flowmeter and its integration into the insulation proved to be a constructive challenge. In addition, the minimum flow velocity required for the vibration measurement required a tapering of the pipe cross-section from 2“ to 1“ thereby causing a considerable pressure loss. Depending on the operating conditions, the polymer may occasionally solidify. This has repeatedly caused irreparable damage to the Coriolis flowmeter. Since the measurements of the two product streams are necessary for operation, the process engineers looked for a replacement that was quick to install after such a failure of the Coriolis instrument.

Solution

The temporary replacement of failed wetted flowmeters is practically always a standard application for the FLUXUS® clamp-on ultrasonic systems from Flexim – and, as always, non-intrusive measuring technology is preferred where the medium and the process conditions pose particular challenges. In addition, “Flexim “ stands for “flexible industrial measurement technology“. The straightforward replacement of the two defective Coriolis meters with a single portable, dual-channel FLUXUS® F601 proved to be such a flexible solution. Due to the high process temperatures of around 540 °F, the ultrasonic transducers were installed on a WaveInjector® at both measuring points. The high-temperature device patented by Flexim separates the transducers thermally from the hot pipe and, at the same time, ensures the best acoustic contact.

The measurement, which was initially intended as a temporary bridging, proved so convincing that the process engineers decided to do without the Coriolis instruments, which are prone to wear and tear, and have high installation and maintenance requirements, and to measure the two polymer partial flows permanently using clamp-on ultrasonic technology. Two stationary FLUXUS® F721 are now used for this purpose. An additional advantage is the high sensitivity of acoustic measurement technology to low flow velocities. Therefore, the tapering of the pipe cross section can be dispensed with, which consequently means less pressure loss and allows a reduction in the pump‘s power consumption.

Marl Chemical Park
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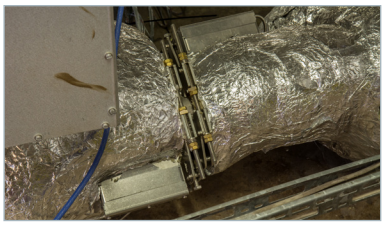
$$H - [NH - (CH_2)_{11} - CO]_n - OH$$

Polyamide 12
© Evonik

Polyamide 12 as VESTAMID® granules
© Evonik

Polyamide 12 as VESTOSINT® powder
© Evonik



Measuring point with the clamp-on ultrasonic transducers attached to the WaveInjector® high temperature device and protruding from the insulation.

Stationary, clamp-on FLUXUS® F721 ultrasonic flowmeters are used as measuring transmitters.

Measuring Points and Instrumentation

Pipelines	2”, stainless steel
Medium	polyamide 12
Measuring Device	2 stationary clamp-on ultrasonic FLUXUS® F721 flowmeters 2 pairs of CDP2E52 clamp-on ultrasonic transducers, each installed on the WaveInjector® WI400 high temperature device

Selling points

- Easy and quick replacement of the two defective Coriolis flowmeters
- Permanently reliable flow measurement without wear due to the highly viscous and solidifying medium
- High sensitivity to low flow velocities means there is no need to narrow the pipe cross-section at the measuring point, thereby increasing plant efficiency

Customer

Evonik Industries AG, Marl Chemical Park, Marl, Germany

Evonik is one of the world’s leading speciality chemicals companies. The company is active in more than 100 countries around the world and generated sales of EUR 13.1 billion and an operating profit (adjusted EBITDA) of EUR 2.15 billion in 2019. Evonik goes far beyond chemistry to create innovative, profitable and sustainable solutions for customers. More than 32,000 employees work together for a common purpose: We want to improve life, day by day.

Marl Chemical Park is one of the largest chemical sites in Germany and, at the same time, Evonik’s largest production location. The site extends over an area of more than six square kilometers and provides employment to around 10,000 people.

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