

Measuring point	Installation	Measuring task
1, 2, 3, 4, 5, 6, 7	feed and transport pipeline	concentration and quality control (incoming goods and caprolactam)
8, 9	transport pipeline	phase detection and separation
9	crystallization unit	monitoring and control of ammoniumsulphate crystallization

Caprolactam Processing

Introduction

Polyamides are among the most common thermo-plastic synthetic materials. Caprolactam (CPL) is the main raw material for these polymers, especially for PA6 (nylon 6). The monomer caprolactam is produced in a complex process, consisting of 4 main parts:

- synthesis of raw caprolactam
- separation and crystallization of ammoniumsulphate
- purification and preparation of raw caprolactam
- polymerisation of polycaprolactam (PA6)

The raw caprolactam production is based on the key intermediate cyclohexanone oxime, which is usually made by cyclohexanone, hydroxylamine and H_2SO_4 . By adding of ammonia and oleum, the raw caprolactam is synthesized and separated of the ammonium sulphate phase. The following steps for the monomer caprolactam are the purification and concentrating (extraction, distillation and crystallization) and the polymerization step. Finally, residual monomers are separated from the polymer (recovery CPL).

Application

The robust inline analyzer LiquiSonic® offers several advantages within quality monitoring and optimal process control at several measuring tasks:

- incoming goods control
- Beckmann rearrangement: H_2SO_4 / oleum
- phase separation of CPL and ammonium sulphate
- crystallization monitoring of ammonium sulphate
- extraction: concentration CPL in solvent
- distillation: concentration CPL in water
- reaktor water: water in caprolactam

LiquiSonic® is used for high-precision concentration value determination (incoming goods, caprolactam), phase detection / separation and process monitoring (crystallization). The internal limit value monitoring signals exceeding or falling below thresholds and transfers the real-time information via analog or digital outputs, serial interfaces, or fieldbus (Profibus DP, Modbus) to the process control system.

Customer value

The LiquiSonic® analyzer provides a precise caprolactam concentration measurement with real-time monitoring. The device is successfully implemented for phase separation between caprolactam and ammonium sulphate.

The robust sensor construction and the optional special materials, like HC 2000 oder PFA, promote long process life. In addition, SensoTech offers sensors approved by ATEX, IECEx and FM.

LiquiSonic® enables a reduction of labor cost through the elimination of manual process steps:

time saving: 1 h per day

cost per hour: 50 € (60 \$)

total cost savings: 10.000 € (12,000 \$) per year

Trough precise LiquiSonic® monitoring, the concentration of residual CPL monomers can be reduced to a minimum, which increases the plant productivity.

Investment: approx. 12.000 € (15,000 \$)

Amortization: < 1 year

Installation

The LiquiSonic® immersion sensor is easily installed into the feed and transport pipelines. Installing the LiquiSonic® sensor eliminates dead space and avoids high installation costs for bypasses.

By using the LiquiSonic® controller 30, up to four sensors can be connected, allowing the simultaneous monitoring of several measuring points.

Typical measuring ranges:

concentration range caprolactam: 70 - 100 wt%

temperature range: 80 - 130 °C (175 - 265 °F)

concentration range caprolactam: 0 - 10 wt%

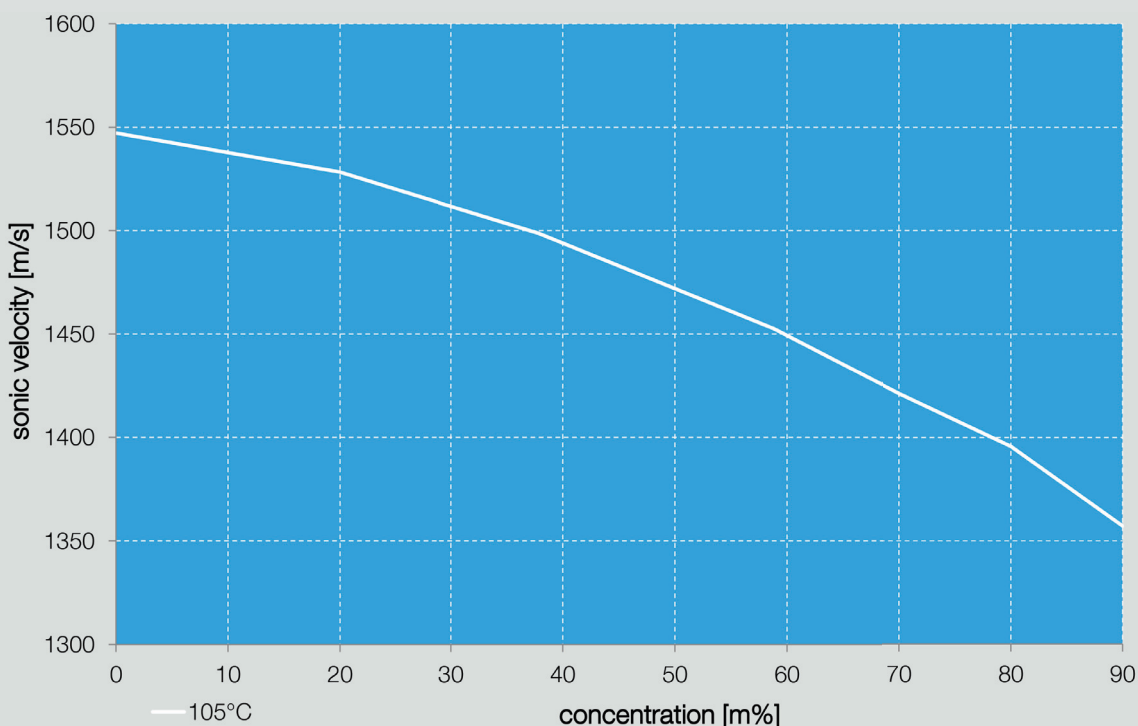
temperature range: 20 - 70 °C (70 - 160 °F)

Incoming goods control:

concentration range oleum : 0 - 30 wt%

temperature range: 10 - 60 °C (50 - 140 °F)

LiquiSonic® sonic velocity measurement in caprolactam



LiquiSonic® 30



	21001311 LiquiSonic® Controller 30 V10
	21010112 Immersion sensor V10 40-14, DIN DN50, L092
	21005215 Maximum rated sensor temperature: 150 °C
	21004435 BUS connection: Profibus DP
	21004449 Network integration
	21004110 High power sensor electronic
	21004202 Bus cable indoor (100m)
	21007846 Factory acceptance test (FAT) certificate



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