DATASHEET A052-CM01 - CATALYSE À HAUTE PRESSION

APPLICATION NOTE A052-CM01

Catalysis at high pressure

Catalysts are being used to accelerate a chemical reaction without actually being consumed. So a small amount of catalyst is sufficient to obtain a large amount of reaction products.

Solid catalysts are often small, highly porous particles, with a large internal surface area in a small volume. This internal surface contains active sites on which the reaction takes place. Gaseous or liquid chemicals diffuse into the pores of these particles, and react at the catalytically active sites to reaction products that diffuse out of the particle. Often, these reactions occur at extreme process conditions.

An energy research organisation investigates a not-specified catalysed chemical reaction of a mixture of hydrocarbon compounds. As the reactor is operated at a high temperature and pressure, Bronkhorst found a solution for injecting chemicals at a low flow under high pressure conditions.



Application requirements

A simple and reliable solution has to be found to inject a liquid flow at a high pressure. This injection has to take place at 30 to 60 bars, and needs to result in a stable flow without pulsation. Furthermore, the liquid flow needs to be controlled accurately, and during the process it has to be known how much liquid actually has been injected.

Important topics

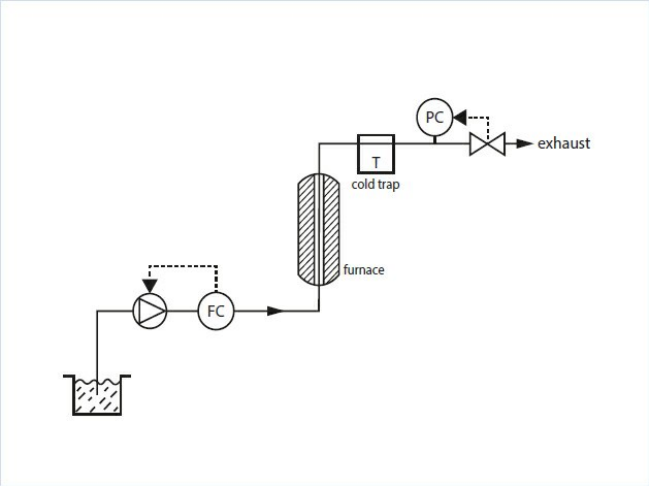
- Low liquid flow at high operating pressure
- No pulsation
- Monitoring of injected liquid

Process solution

Vannes de régulationThe solution comprises a Coriolis mass flow meter that controls a HPLC piston pump at the inlet side of the reactor and an independently operating back pressure controller at the outlet side. The tested M12 mini CORI-FLOW flow meter is a very stable and accurate instrument, however the ML120 mini CORI-FLOW flow meter has proven to be better in this case. The WADose HPLC pump gives a very stable flow without pulsation. The combination of HPLC pump and mass flow meter works as a mass flow controller. The control valve of the Coriolis flow meter is not necessary, as the pump is used as an actuator.

The pump can handle a liquid viscosity of max. 40 mPa.s at the upstream side. The maximum operating temperature is 70 °C. The temperature of the furnace that contains the reactor tube with small catalyst particles is much higher. The pressure at the reactor tube outlet has to remain at a high value. Beyond the outlet there is a cold trap for water or oil condensation, a back pressure controller (P-502C) with control valve (F-033C) that can handle pressure differences up to 400 bars and an exhaust to atmospheric pressure.

The pressure controller can handle gas and liquid in a very stable controlled flow. Especially at very small flow rates, this pressure controller has a much better control performance than a mechanical pressure reducer. The exhaust is used to remove gas that has been produced at the reaction. The pump has three control modes: pressure, volumetric (only the speed of the piston is controlled) and mass flow. The latter is a special feature that can be offered, and is convenient from a chemist's point of view. As the flow can be controlled directly, the exact number of moles injected to the process is known. Control and monitoring occurs via the digital interface. The mass flow measure and setpoint, density, temperature and counter value are visible via this single digital interface. The success of this setup has been demonstrated by a recent order of three additional pumps.



Flow scheme

Recommended Products



MINI CORI-FLOW™ M12

Débit 0…200 g/h

Pression 200 bar

Indépendant des propriétés du fluide

Grande précision



MINI CORI-FLOW™ ML120V00

Débit 0…200 g/h

Pression 200 bar

Indépendant des propriétés du fluide

Grande précision



EL-PRESS P-502C

Pression min. 2...100 mbar
Pression max. 1,28...64 bar

Pression absolue ou relative

Grande précision



SERIES F-033, F-042

Vannes Vary-P

Débits jusqu'à 100 ln/min
100 ln/min

Pression max. 400/700 bar

Pour les applications à haute pression / haute ΔP

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