DATASHEET APPLICATION NOTE A076-CM01 - BACK-PRESSURE REGULATION FOR CATALYST RESEARCH

APPLICATION NOTE

Back-pressure regulator for catalyst research

Pressure controllers are used in catalyst research processes to analyse the chemical composition of the exhaust coming from a reactor. In this process, high temperatures and pressures are needed to prevent condensation of the chemical compound. To find out under which process conditions a catalyst will perform optimally for a specific chemical reaction, a large pressure range has to be investigated. To this end, a Bronkhorst pressure controller is used to pressurise a dome-load back pressure regulator.

Catalysts are substances that allow chemical reactions to proceed at lower temperatures. Even though, many chemical reactions that involve catalysts still occur under extreme conditions. For example, Fischer-Tropsch reactions, where a gaseous mixture of carbon monoxide and hydrogen is converted into (liquid) hydrocarbons at high temperature and pressure over a solid catalyst.

Application requirements

In this application an accurate control of the pressure itself and a large pressure range had to be covered. Moreover, a suitable control device should be able to deal with high pressures, high temperatures and low flows. As the valve of the pressure regulation needs to be resistant to high temperatures and several different chemicals, a traditional spring-loaded valve is not suitable. Therefore, a dome loaded back pressure regulator can be a good solution. As products can be gaseous as well as liquid, the pressure controller should be suitable for gases, liquids and two phase flow.

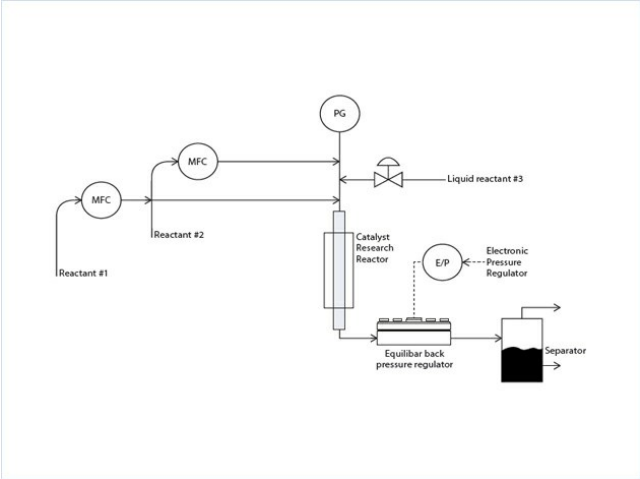
Important topics

- Accurate control of process pressure
- Back pressure regulator cover large pressure range
- Reduce consumption of high-pressure gas
- Suitable for gas, liquid, gas/liquid combination

Process solution

A combination of a Bronkhorst EL-PRESS Process Pressure Controller (PPC) with two integrated high pressure solenoid control valves in a forward and back pressure control loop and a dome-loaded back pressure regulator is used to regulate the back pressure of a catalyst research reactor.

In the dome-loaded back pressure regulator, a flexible dome-shaped membrane separates a reference chamber from a process chamber. The EL-PRESS Process Pressure Controller (PPC) determines the pressure in the reference chamber, which in turn controls the pressure in the process chamber - which is directly connected to the catalyst research reactor. A pressure sensor measures the reference pressure based on a setpoint, and the PID controller will decide whether the inlet valve should open to increase the process pressure, or the relief valve to decrease this pressure. The internal PID controller will guarantee a smooth pressure change. Set at the right pressure, the dome-loaded back pressure regulator will keep the desired process pressure.



Flow scheme

Typical catalytic processes occur at pressures ranging from several tens of bars to a few hundred bars. Nitrogen from a gas cylinder can be used to pressurise the reference side of the dome. As 200 bar is the maximum gas pressure in such a cylinder only the difference between this pressure and the process pressure can be used to control the latter. Hence, the PID controller and the small dead band will help to sparingly use the pressure difference and to reduce the consumption of high pressure gas. The valves used in this unit are capable of handling a pressure difference of 200 bar.

Recommended Products

EL-PRESS P-802CV

Min. pressure 17,5...350 mbar
Max. pressure 3,2...64 bar
Absolute or gauge pressure
Fast or smooth pressure control

IN-PRESS P-812CI

Min. pressure 3,2...64 bar
Max. pressure 5...100 bar
Absolute or gauge pressure
Fast or smooth pressure control
Rugged IP65 construction

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