DATASHEET APPLICATION NOTE A096-EN99 - FLOW CONTROL IN FORMIC ACID PRODUCTION

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Flow control in formic acid production

The replacement of fossil fuel is a hot topic these days, a lot of research has been done towards sustainable fuels. Team FAST, a Dutch multidisciplinary student team of the Eindhoven University of Technology (TU/e) is working on an initiative, introducing a revolutionary sustainable fuel called Hydrozine.

Hydrozine is defined as a sustainably produced formic acid. Hydrozine technology is only sustainable if the entire chain is durable. This means using formic acid extracted from plants, or mixing carbon dioxide with water using sustainable electricity to create Hydrozine. Using the latter, team FAST wants to prove that Hydrozine is a suitable candidate for replacing fossil fuels in applications in the heavy transport industry (such as buses and generators). For this, they developed a prototype called 'REX'.

Application requirements

REX is a standalone generator using Hydrozine as fuel. An in-house developed catalyst is used here to convert Hydrozine into hydrogen (H_2) and carbon dioxide (CO_2) much easier, more stable and more energy-efficient than any previous catalyst.

The challenge in this process is to measure the gas mixture containing H_2 and CO_2, as this is quite specific. Moreover, it is very important to measure whether or not gas is produced, otherwise the formic acid could be piling up in the reactor and make it to overflow. A reliable measurement is therefore desired.

Important topics

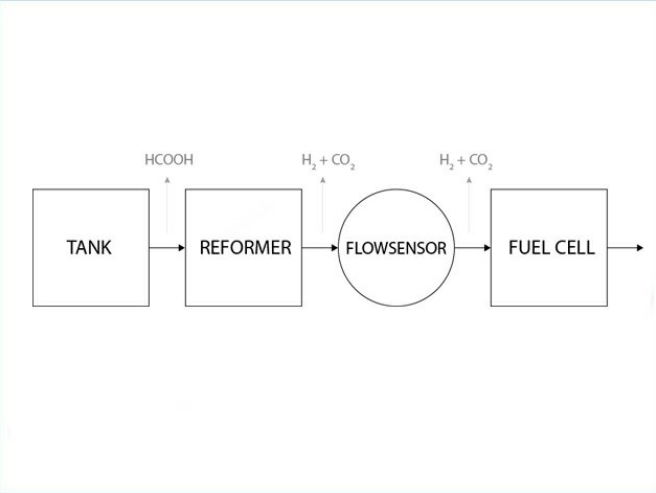
- Determine exact gas flow
- Efficient testing of parameters
- High quality
- Accurate and reliable measurement

Process solution

The purpose of the 'REX' system is to turn Hydrozine into electricity: the liquid Hydrozine (HCOOH) is stored in the 'REX' system at atmospheric level and subsequently pumped into a reformer. Here the in-house developed catalyst is used to convert the Hydrozine into the gases hydrogen (H_2) and carbon dioxide (CO_2). The hydrogen and carbon dioxide flow towards a fuel cell where they react with oxygen from the air, which results in the generation of electricity.

Water vapour and carbon dioxide are being emitted into the air after the electricity is extracted, which are the same components that are used to create Hydrozine. This completes the circle in making this energy carrier carbon neutral.

The REX system has been equipped with Bronkhorst thermal mass flow meters (IN-FLOW series) as it is desired to measure the amount of gas being produced. Knowing the gas flow provides information about how quickly gas is being converted by the system and thus information about the amount of power which can be generated. In this way different parameters can be tested to improve the efficiency.



Flow scheme

"Bronkhorst had the expertise of this particular gas and was able to provide us with the right parts and support. The Bronkhorst mass flow meters are of high quality and made it possible to accurately measure the gas production, which was not possible for us before. We could even measure the difference between the formic acid that goes in and the gases that came out. As the difference between this should be zero, the Bronkhorst flow sensor was the only one which could actually prove this".

"Without Bronkhorst we were not able to test the system. So great thanks to them, for enabling our testing process during the summer!" according to Team FAST.

Recommended Products

IN-FLOW F-113AI

Min. flow 4…200 ln/min
Max. flow 8…1670 ln/min
Pressure rating 100 bar
Compact IP65 design
High accuracy

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