Gasification Process Downtime Reduced and Safety Improved with Application and Industry Solutions (AIS) Temperature Sensors

RESULTS

- Reduced unscheduled shutdowns
- Improved plant safety
- Improved throughput
- Reduced maintenance

APPLICATION

Gasification reactor temperature measurement

CUSTOMER

Synthetic crude oil producer in North America

CHALLENGE

This process uses bitumen from oil sands as a feedstock and converts it to synthetic crude oil using gasification technology. Gasification reactors operate at high pressure and temperature, with potentially dangerous gases such as hydrogen, and contaminants such as sulphur. Pressures of 65 bar or more (940 psi +), and temperatures of 1600 – 1800 °C (2900 – 3200 °F) are common. The gasification process works most efficiently at a target temperature so an accurate and reliable temperature measurement must be maintained in these very adverse process conditions.

Contaminants are present in the feedstock, and generated as part of the gasification process. These contaminants can become embedded in the precious metal temperature sensor elements and change the electrical and mechanical properties of the sensor. This can lead to measurement errors and sensor failure, sometimes within weeks. In addition, the contamination can degrade the integrity of the sensor seals. This can lead to mechanical failure of the sensor and the release of process contents into the plant.

Inaccurate temperature measurement can lead to reduced efficiency of the gasification process. Loss of the temperature reading can lead to using inferred temperature to control the reactor. This puts the integrity of the reactor, and therefore plant safety at risk. Loss of the temperature reading can also lead to a process shutdown and lost revenue. Finally, maintenance costs increase due to the need to frequently shut down the reactor, replace sensors, and restart the reactor.

Figure 1. Rosemount Sapphire Sensor

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SOLUTION

A Rosemount Sapphire Sensor was used to address these challenges. The sensing element is surrounded by a sapphire protection tube. This sapphire protection tube is surrounded by a second ceramic tube. This dual tube design is highly resistant to penetration by contaminants even in these extreme process conditions. As a result the sensor electrical characteristics are not degraded, the sensor accuracy is maintained, and sensor life is extended from just a few weeks to 12 to 18 months. The Rosemount Sapphire Sensor also uses a dual sealing and the weldless connection head construction technique, which is highly resistant to mechanical failure. In the event that the inner sapphire tube is compromised, the dual seal system keeps the high temperature, high pressure process gases safely contained until the next planned process shutdown.

This solution brings many positive business results. Accurate temperature control is maintained leading to improved process efficiency. In addition, the risk of an over-temperature condition is reduced improving the integrity of the reactor and overall plant safety. The risk of sensor mechanical failure is also reduced improving plant safety. Throughput is improved due to reduced downtime and finally, operations and maintenance costs are reduced due to fewer shutdowns and reduced maintenance.

RESOURCES

Rosemount Temperature

http://www.emersonprocess.com/rosemount/products/temperature/index.html

Rosemount Application and Industry Solution Sensor

http://www2.emersonprocess.com/en-US/brands/rosemount/Temperature/AIS-Sensors/Pages/index.aspx

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00830-0700-2654, Rev AA