LUNA

CASE STUDY

HD-FOS for Characterizing Heat Exchangers

ABOUT T.U. BRAUNSCHWEIG & CALGAVIN LTD.

Industry: Civil

The largest in Northern Germany, the Technical University of Braunschweig is commonly ranked among the top universities for engineering in Germany. TU Braunschweig research profile is interdisciplinary, but with a focus on manufacturing, aeronautics, vehicle engineering, life sciences, and meterology.

Established in 1980, CALGAVIN provides heat transfer solutions to new designs of heat exchangers and problematic heat exchangers in the field. Its engineering team is recognised worldwide for knowledge of thermodynamics, heat transfer and fluid flow. Through offering realistic and practical solutions the company has improved heat transfer performance across many sectors of the Process Industry.

The Challenge

Heat exchangers, evaporators and reactors are integral pieces of equipment in many industries including chemical refining, pharmaceutical production, and food processing. This equipment is seald, opaque, and in many instances involves the use of fluids that are corrosive, flammable, or explosive.

It is imperative to obtain a clear picture of the performance inside the equipment in order to maximize yield, minimize equipment costs, and safeguard the equipment against normal degradation, fouling and scale. Traditional point sensors, however, make this process difficult and often yield inadequate data for an effective design optimization.

The Solution

Luna Innovations, in conjunction with the Technical University of Braunschweig and CALGAVIN LTD. of Alcester, UK, worked together to optimize the design of a heat exchanger used in the processing of Hexanol - a highly flammable substance. The goal of Luna's unique design approach was to minimize both the size and cost of the heat exchanger, as well as to optimize the heat transfer process for maximum yield under all operating conditions.

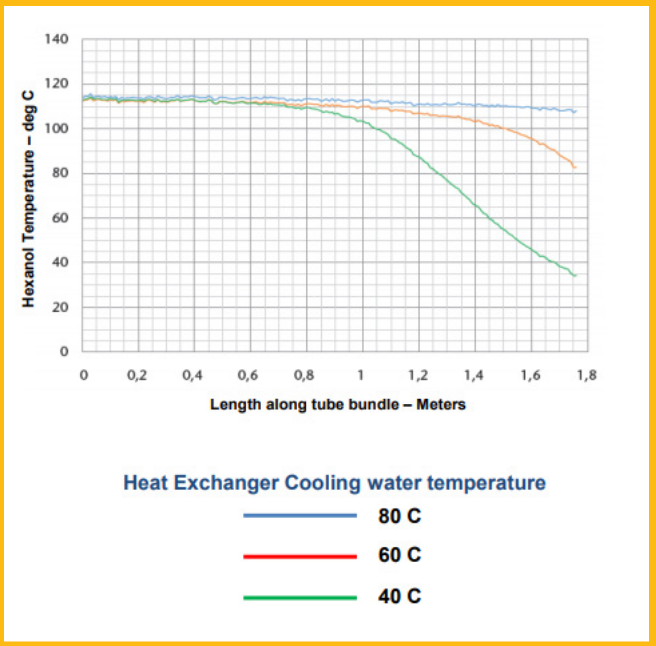
Luna's High-Definition Fiber Sensing (HD-FOS) solution uses

a single optical fiber to act as a distributed sensor, providing thousands of temperature points. In this case, Luna's high-definition fiber optic sensing system was used inside the heat exchanger to provide a distributed temperature measurement of the hexanol being condensed by circulating water. The distributed temperature probe was constructed by inserting a high-definition fiber optic sensor inside a stainless-steel capillary tube, which can be easily inserted inside the heat exchanger and provide a temperature measurement every millimeter along the length of the sensor.

The Results

As a result of using Luna's ODiSI interrogator with high-definition fiber optic sensing, changes were made in the design of the cooling tube layout within the heat exchanger to improve performance at a reduced heat exchanger cost. Futhermore, a deeper understanding of the operating envelope under varied operating conditions was obtained.

Heat Exchanger for Condensing Hexaol



Profile of condensing point of Hexanol:
Test conducted with cooling water temperatures of 40C, 60C, & 80C.
Heat exchanger pressure = 200 mbar

INSTRUMENTS USED

Luna's ODiSI interrogator was used in conjunction with HD-FOS temperature sensors and (8) channel optical switch, which can be used to serially interrogate multiple sensors. Luna offers both an (8) and (36) switch that can convert a single channel interrogator into a multi-channel system.

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