Application Note

Real-time Fluid Level Monitoring for the Kraft Pulping Process

The Challenge

In the Kraft pulping process, wood is converted into wood pulp containing cellulose fibers to produce paperboard and paper. The process is becoming increasingly sophisticated with new and higher requirements driven by, for example, larger quantities of high-value secondary product streams such as lignosulfonates and crude tall oils. In addition, more demands will be seen on the energy production out of the process combined with larger variations in feedstock and produced products.

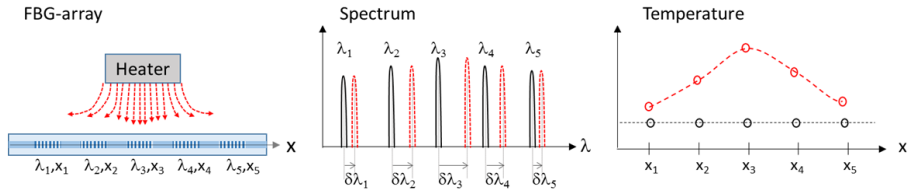
To meet these new requirements, the sizes and sophistication of the process equipment are increasing. Process monitoring for optimisation is, therefore, becoming increasingly important. This leads to a growing need to collect high-quality data from a large number of temperature measurement points to enable live visualization of the process for operators, and to instantly supply DCS and PLC systems with fast and accurate process control parameters.

The Solution

Proximion's optical fiber array temperature sensing is ideally suited to meet this measurement challenge. It uses miniature fiber Bragg grating (FBG) sensors and supports a large number of measurement points with a single sensing cable, is zero power and so intrinsically safe, and provides high resolution dynamic measurements over an extraordinarily large temperature range. With Proximion technology, it becomes possible to follow the process live, store data and distribute control parameters through communication protocols such as OPC-UA etc.

Together with a leading Swedish pulp and paper producer, Proximion engineers have identified several potential applications for fiber optic multi-point temperature sensing. The most promising ones, currently under testing or evaluation are:

- Decantation tanks for the extraction of high-value crude sulphate soaps that are further processed to become crude tall oils (monitoring the separation process);
- Continuous digester for the core pulping process (monitoring the pulping process); and
- Filtrate tanks acting as critical water buffers in the process (monitoring stratification in tanks).



Showing how the wavelength changes of multiple FBGs on a fiber can measure a distributed temperature profile.

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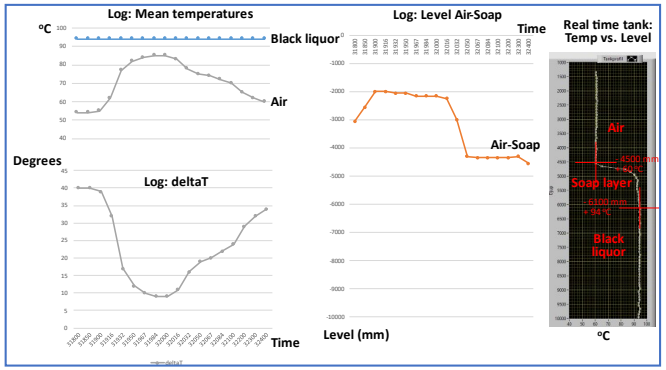
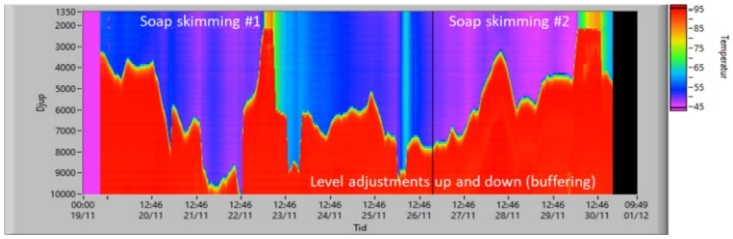
In the example shown below, a Proximion system was installed to monitor the temperature stratification occurring in decantation tanks used for extracting crude sulphate soap. A hot black liquor at ~95°C is feed into the tank from the bottom, a cooler layer of crude sulphate soap is formed above and at the top hot air is present.

The vertically mounted Proximion fiber optic multi spot temperature sensor has been able to follow the thickness and position of the soap layer and see the temperature distribution of the layers. A feedthrough was mounted on the tank roof to fix the sensor and make connection to the instrumentation (interrogator). The measurement length of the sensor was 9 meter and included 91 temperature points. The sensing fiber was encapsulated in a stainless-steel tube with an outer diameter of 2.6 mm and was fixed to the bottom of the tank by a wire. The tests were deemed very successful and a full system serving multiple tanks with a jointly tailored GUI for the operators is now under an investment request.



Data from a Proximion installation at major Swedish pulp & paper producer showing the soap layer in a decantation tank.



Time series data showing the soap layer movements during the skimming process.

Installing the 10m fiberoptic temperature probe with 100 measurement points

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