Grant Agreement number: 613647

Project acronym: BREADGUARD

Project title: Development of a cost-efficient, precise and miniaturized sensor system for quality and performance control in baking processes

An executive summary

In BreadGuard a consortium of 6 SMEs and 3 RTDs from 3 different countries across Europe worked on a Sensor System enabling the stearing of baking processes in a new and innovative way.

The BreadGuard Sensor Control System consist of two different sensors, an ultrasonic sensor and a nano-spectrometer sensor. Both systems have been developed separately, combined afterwards into a whole Sensor System with a corresponding software and integrated in a deck-oven (batch line) from MIWE. It was also supposed to be integrated in a tunnel-oven (continous line) from SCHENK, but could not be done due to the insolvency of Schenk in early 2016 and as well due to the later the suspension of the project.

During the lifte time of the project until the suspension the BreadGuard Consortium could successfully develop the hardware for the nano-spectrometer and the ultrasonic sensors (emitter and transmitter system). Also, the software to combine the two sensors has been developed successfully. The second part of the software developments concerned the connection of both sensors to the oven operating software to enable the automated control of the baking processes.

The ultrasonic sensor determines bread doneness by sending out ultrasonic waves at low frequency (ultrasonic transmitter) and measuring the amplitude of the received signal, both reflected by as well as penetrated through the bread.

The nanospectrometer monitors different process parameters during the baking process, i.e. the degree of browning, temperature and humidity. A light beam is omitted, passing the oven interior and finally hitting the sensor. The wavelength range is related to the process parameters and spans the visible (VIS) and near infrared (NIR) spectral range. The measurement procedure is performed in the ambient air of the oven (e.g. humidity) as well as on the surface of the product (e.g. degree of browning). The monitoring and control module obtains the specific data from the sensors and send output signals to adjust the humidity level as well as the temperature. Furthermore, the baking process ends in case a certain bread doneness has been detected. All data from each baking process (temperature/humidity curves, process time, etc.) are recorded and saved as part of the Quality Management System.

The sensors have partly been tested at lab scale level so far (without humidity tests) and should be tested at industrial level directly in the production and production lines of participating SMEs. At the end of the project, the BreadGuard Consortium intended to deliver an optimised BreadGuard Sensor System.