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Cross-sectorial real-time sensing, advanced control and optimisation of batch processes saving energy and raw materials (RECOBA)

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Fibre optical temperature sensor for monitoring temperature development of high-temperature fluids during batch processing

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Dissimination level

PU	public	<input checked="" type="checkbox"/>
PP	restricted to other programme participants (incl. the Commission Services)	<input type="checkbox"/>
RE	restricted to a group specified by the consortium (incl. the Commission Services)	<input type="checkbox"/>
CO	Confidential, only for members of the consortium (incl. the Commission Services)	<input type="checkbox"/>

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1 Design and Construction



Figure 1: Fibre optical temperature sensor

The fibre optical temperature sensor to monitor the liquid steel temperature was designed and constructed. It consists of the basic unit, the pressure vessel, the connection hose and the injection box. The basic unit contains the electric, electronic, and pneumatic components. In the pressure vessel the optical fibre is contained. The Injection box is used to seal the connection to the process gas system. Instead of the

injection box, also a hand lance can be connected for flexible temperature measurements in the liquid steel from the top.

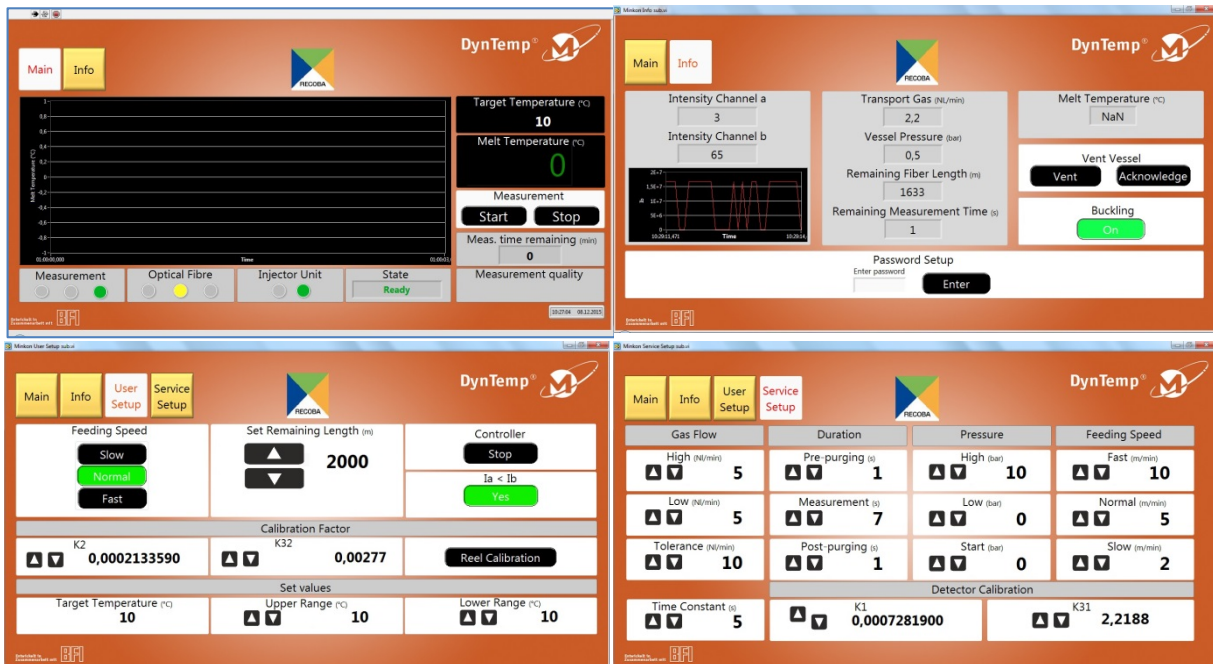


Figure 2: Grafical user interface

A new software programme was created to operate the measurement system and to automatically handle different safety features in real time. It has a graphical user interface for easy use by the operator. It also visualises and saves the measurement results, and allows changing the measurement settings.

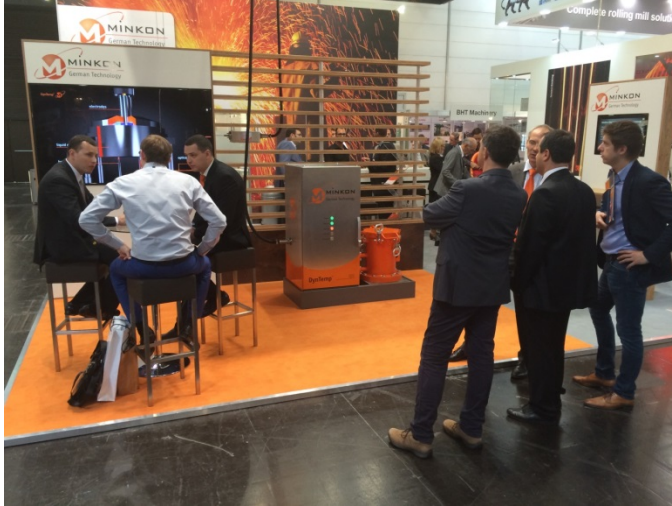
2 First industrial trials

First industrial trials have been performed at an induction furnace in a foundry. Using a hand lance the optical fibre is immersed into the steel melt. By comparison of the measured melt temperature to reference thermocouple measurements a calibration of the fibre optical temperature sensor has successfully been performed.



Figure 3: Photograph during hand lance temperature measurement using fibre optical sensor at foundry induction furnace

3 Exhibition



The fibre optical device has been displayed to the public at the Minkon booth of the METEC exhibition at the Düsseldorf trade fair center in June 2015. This highly innovative device received a lot of interest.

4 Specification:

Measurement:

- Minimum duration 10 s
- Maximum duration 200 min.
- Temperature range 1485 – 1750 °C

Basic unit:

- Gas tight: up to 10 bar
- Relief pressure valve
- Pressure monitoring
- HxWxD [mm] 1381x1200x600

Location:

- Surrounding temp. max. 45°C
- Electric supply 230 V, 10 A
- Transport gas 100 l/min stp
- (Ar for stirring stand, Ar/N for RH)

Piping between basic unit and injector:

- Length max. 20 m
- Outer diameter min. 25 mm
- Co-axial guide of fibre feeding hose and control for automated ball valve

Dimensions of injector unit:

- HxWxD [mm³] 300x200x123
- Injector tube 3,0 mm x 0,5 mm
- Length injector tube: max. 500 mm
- Surrounding temp. max. 70 °C
- Connection to process gas by T-connector

Communication Interface between basic unit and notebook controller at the control room:

- Ethernet TCP/IP protocol
- Copper cable