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Radio-frequency sensor for flux powder thickness measurement in billet / blooms continuous casting mould

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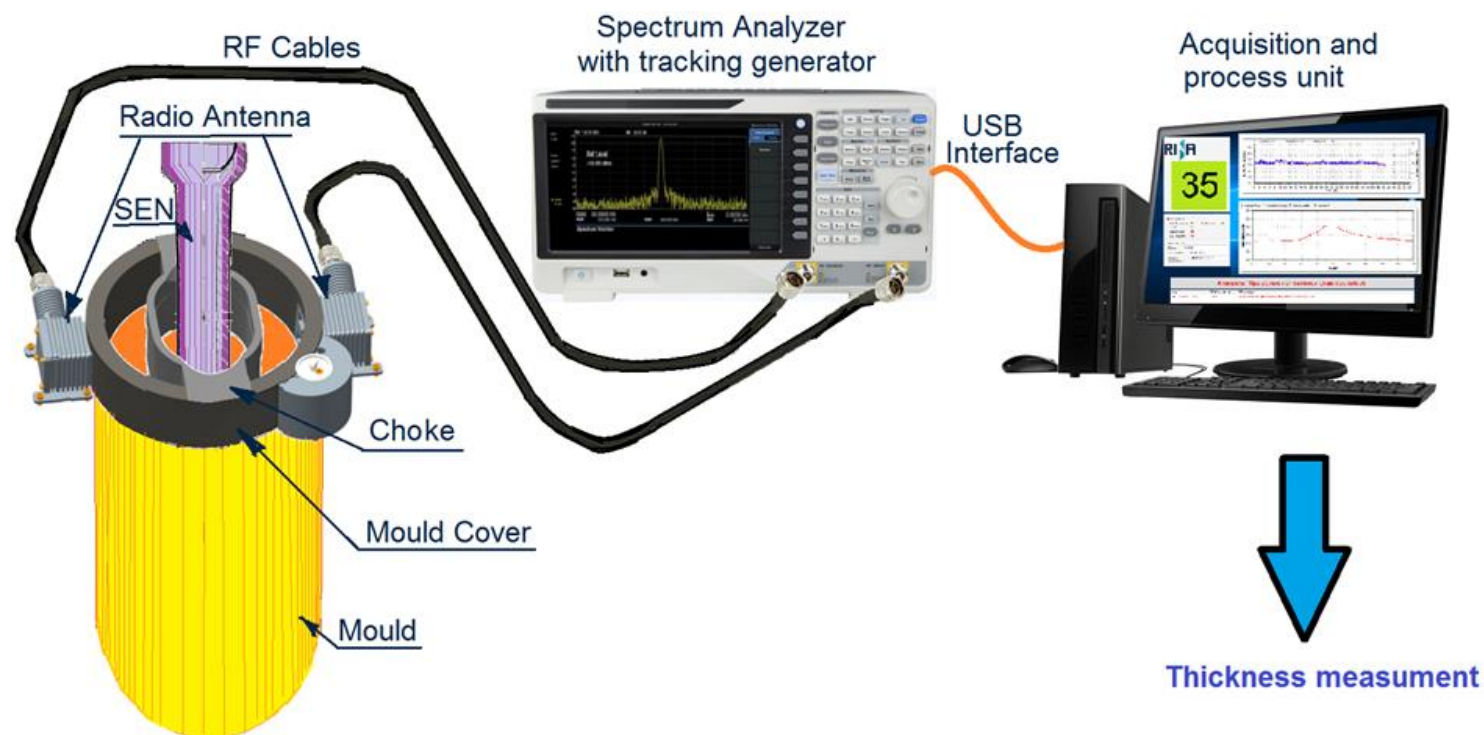
Flux powder thickness measurement in billet / blooms continuous casting mould



Good solidification conditions determine a good surface quality of the as-cast products and guarantee the expected productivity levels. Among the various parameters that contribute to achieve a proper solidification, two are of particular importance:

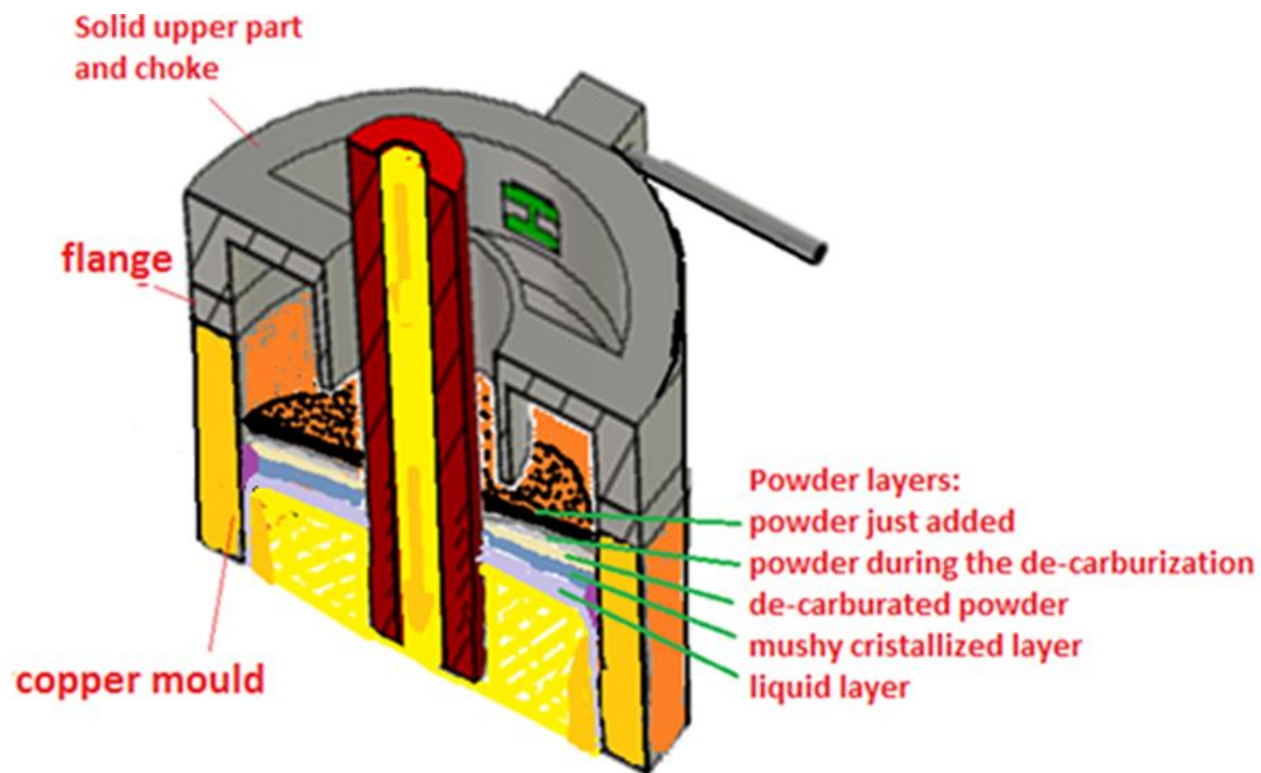
- **the effectiveness of powder feeding in mould and**
- **the maintenance of a stable position of the steel level.**

MEASUREMENT PRINCIPLE OF RADIO FREQUENCY (RF) SENSOR (1/2)



Measurement setup for the radiofrequency (RF) sensor

MEASUREMENT PRINCIPLE OF RADIO FREQUENCY (RF) SENSOR (2/2)



Scheme of RF sensor applied on mould

APPLICATION OF RADIO FREQUENCY SENSOR TO CONTINUOUS CASTING MOULD



RF sensor installed on a strand for 160x160 size square billet

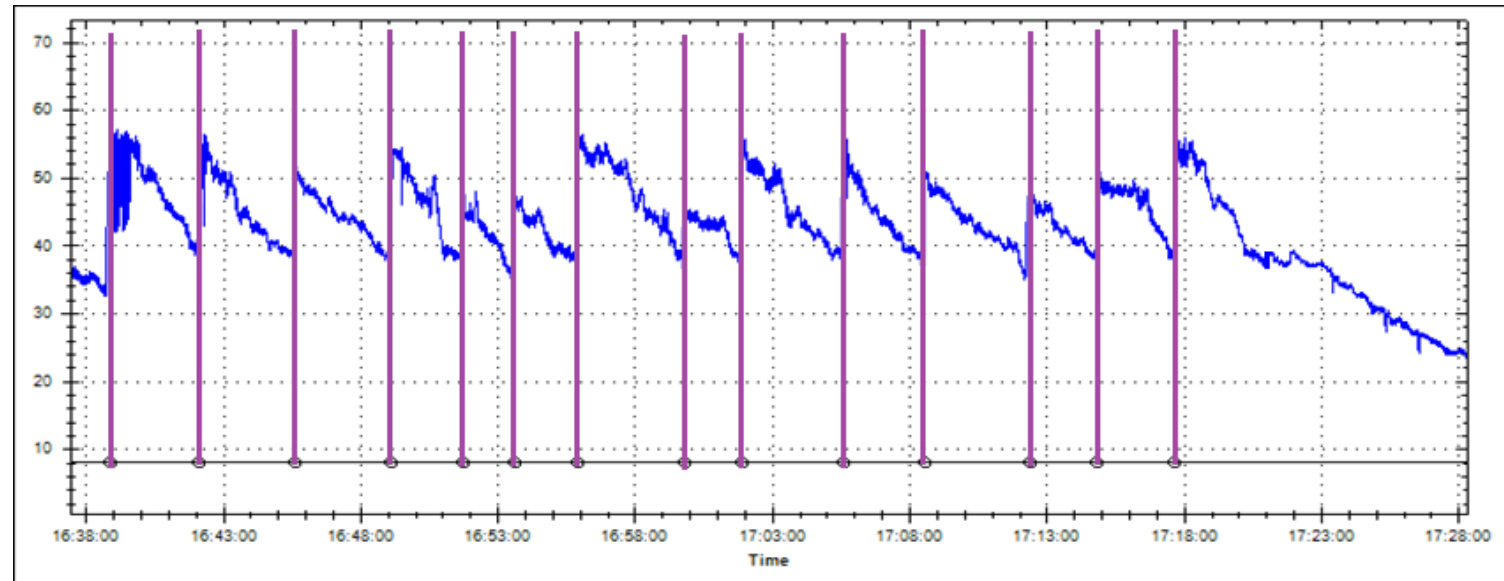


RF sensor during the casting with powder feeder for 205x205 size square billet



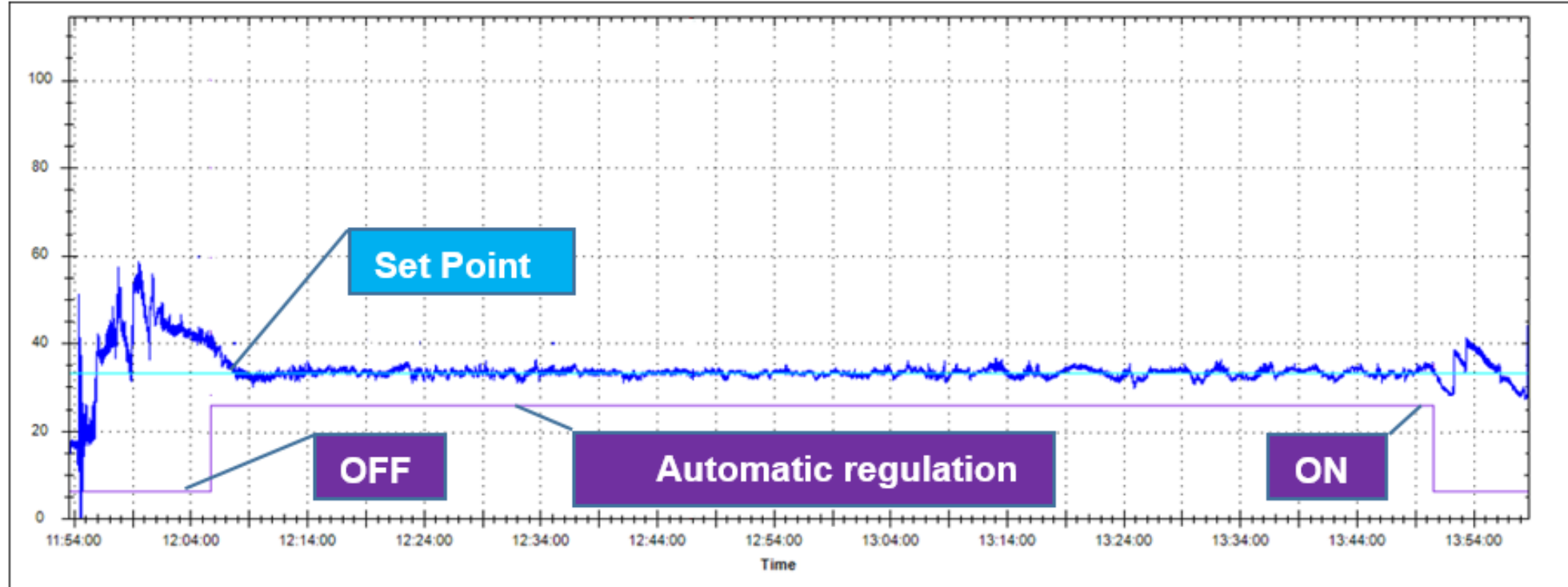
Round bloom $\varnothing 270$ mm strand equipped with RF sensor

Manual feeding of the mold powder



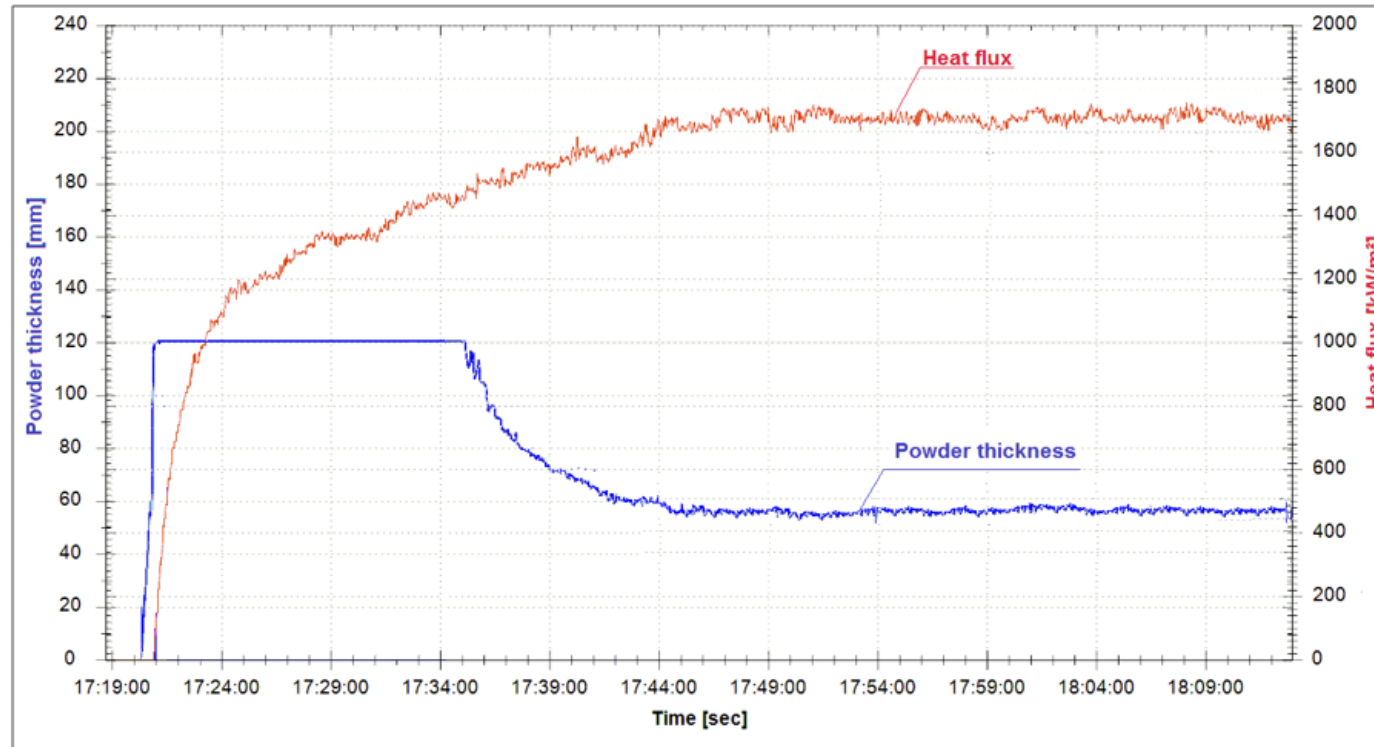
Powder thickness measured by RF sensor - Manual addition of powder with RF sensor in measurement. Segments indicate the instants of powder addition ($300 \div 400 \text{ cm}^3$).

Automatic feeding of the mold powder (1/3)



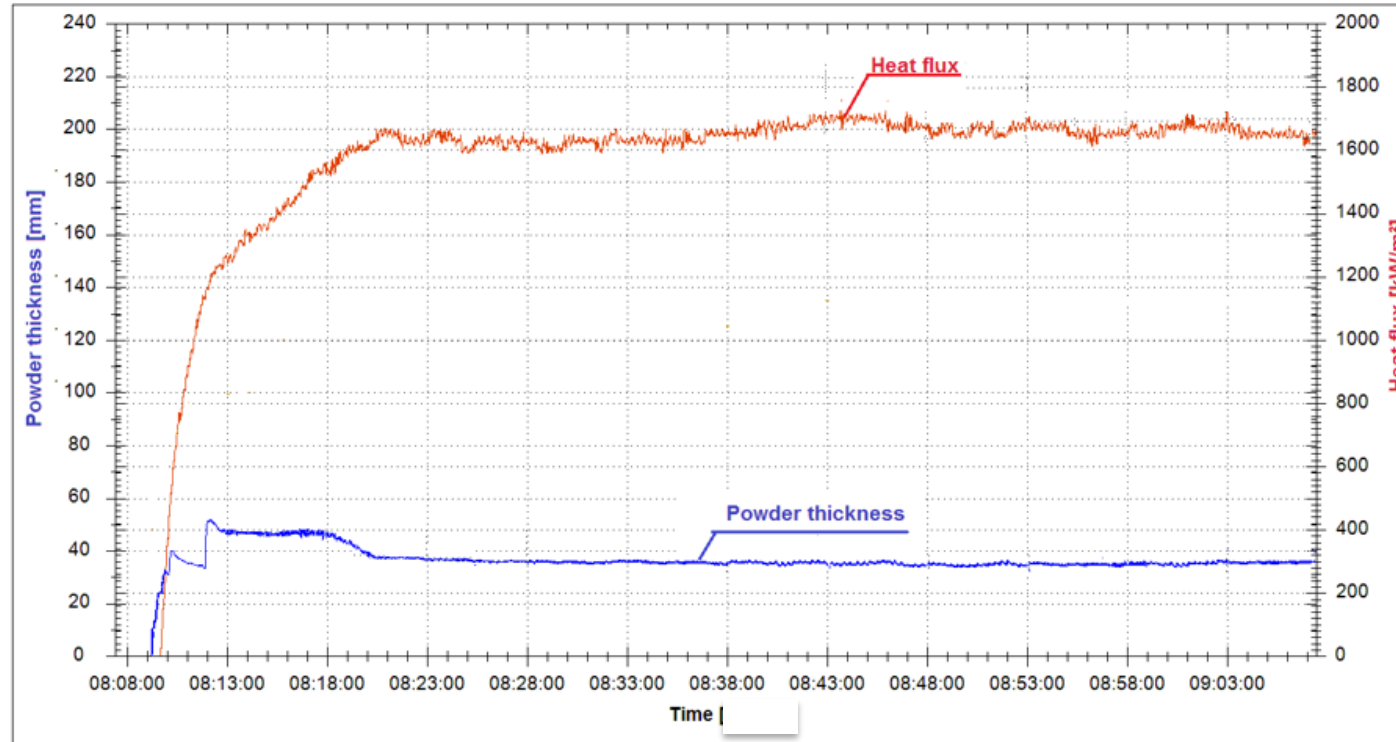
Powder thickness measured by RF sensor - Sequence of two heats with automatic regulation of powder feeding. The regulation was active from 12:06 up to 13:50 and the set-point was established to 34 mm

Automatic feeding of the mold powder (2/3)



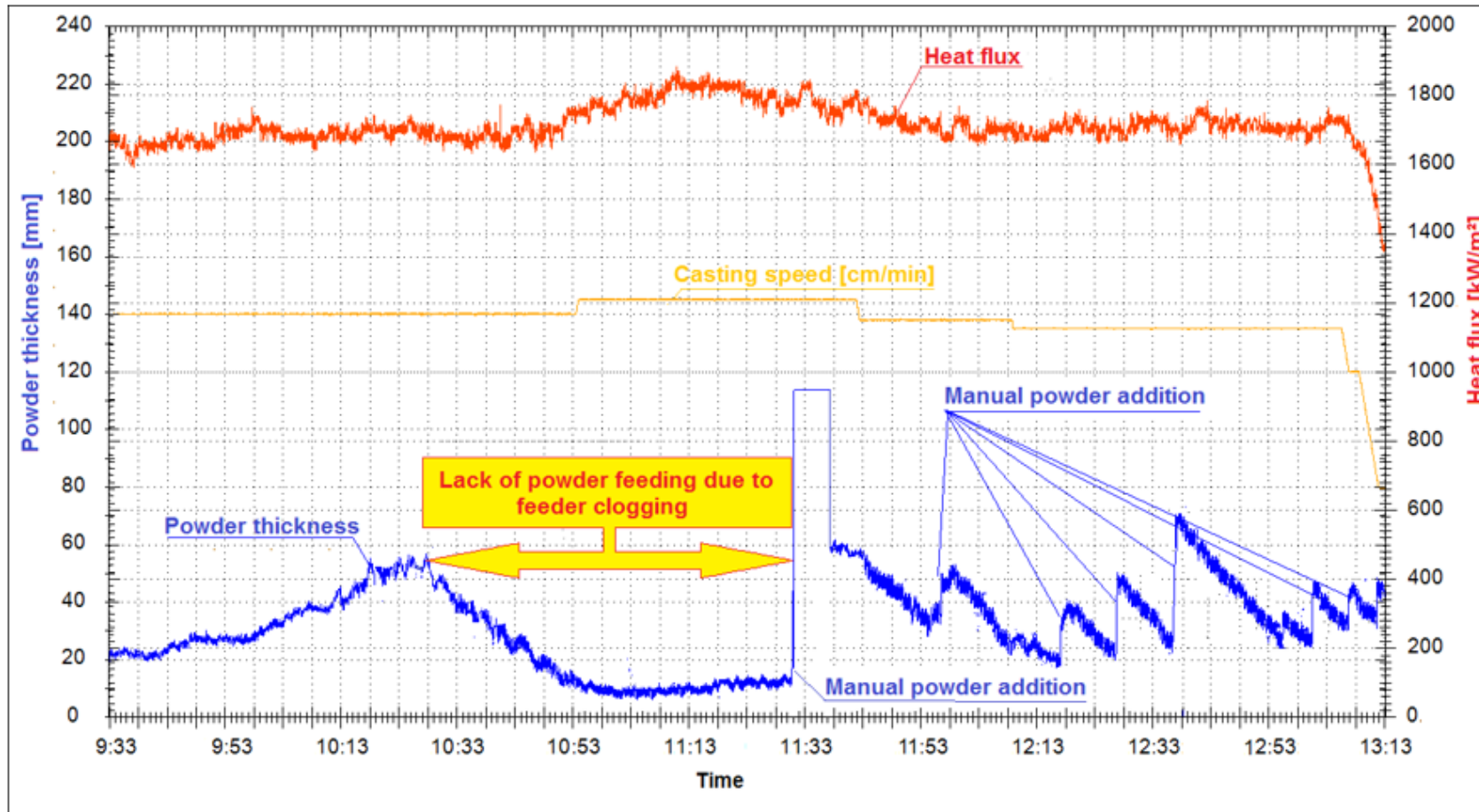
RF sensor highlights the effect of excessive manual powder feeding at the beginning of casting which causes a slow growth of the extracted heat flux until the powder thickness stabilizes around a reasonable value. The set-point of powder was established to 55 mm.

Automatic feeding of the mold powder (3/3)



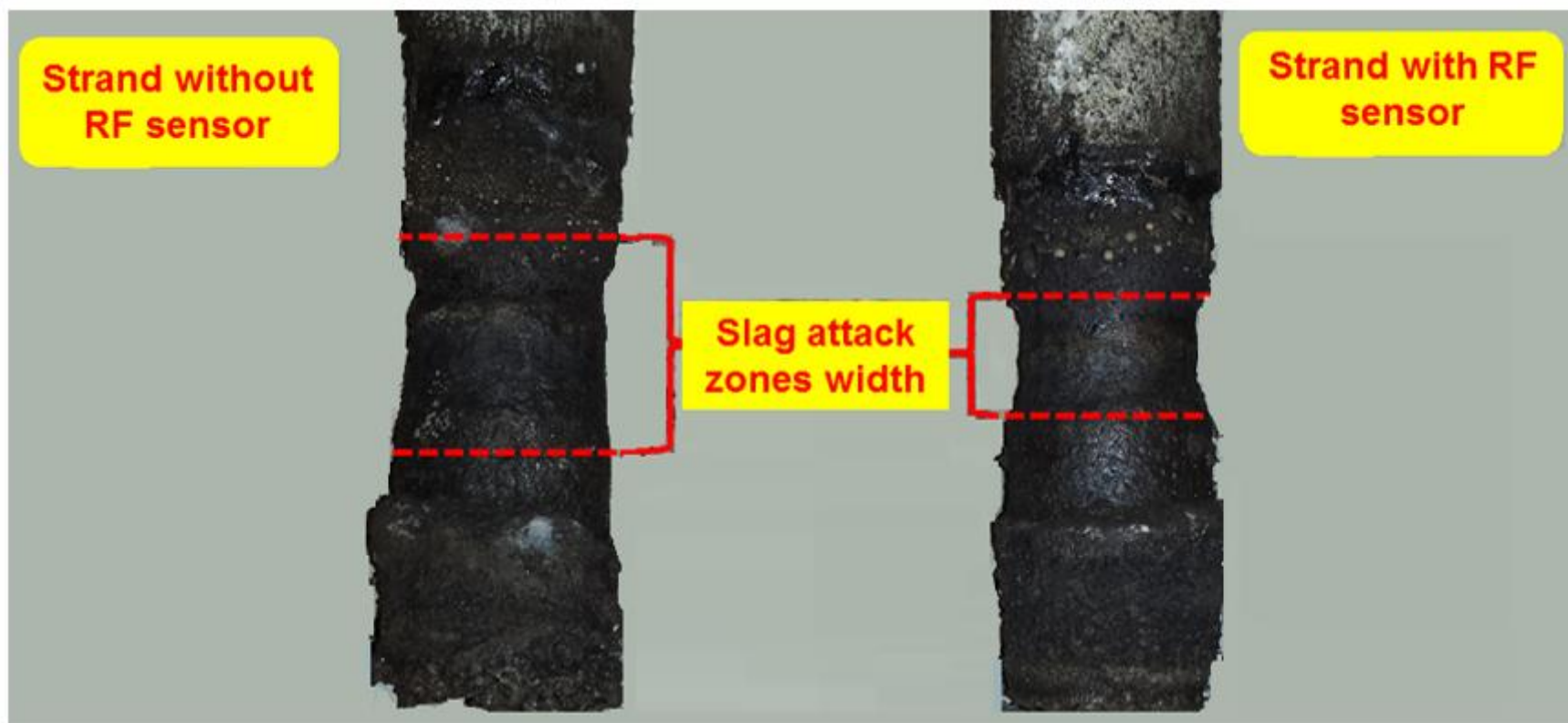
RF sensor highlights the effect of correct manual powders feeding at the beginning of casting which causes standard growth of the extracted heat flux. The set-point of powder was established to 36 mm

Conditions of lack of mold powder supply



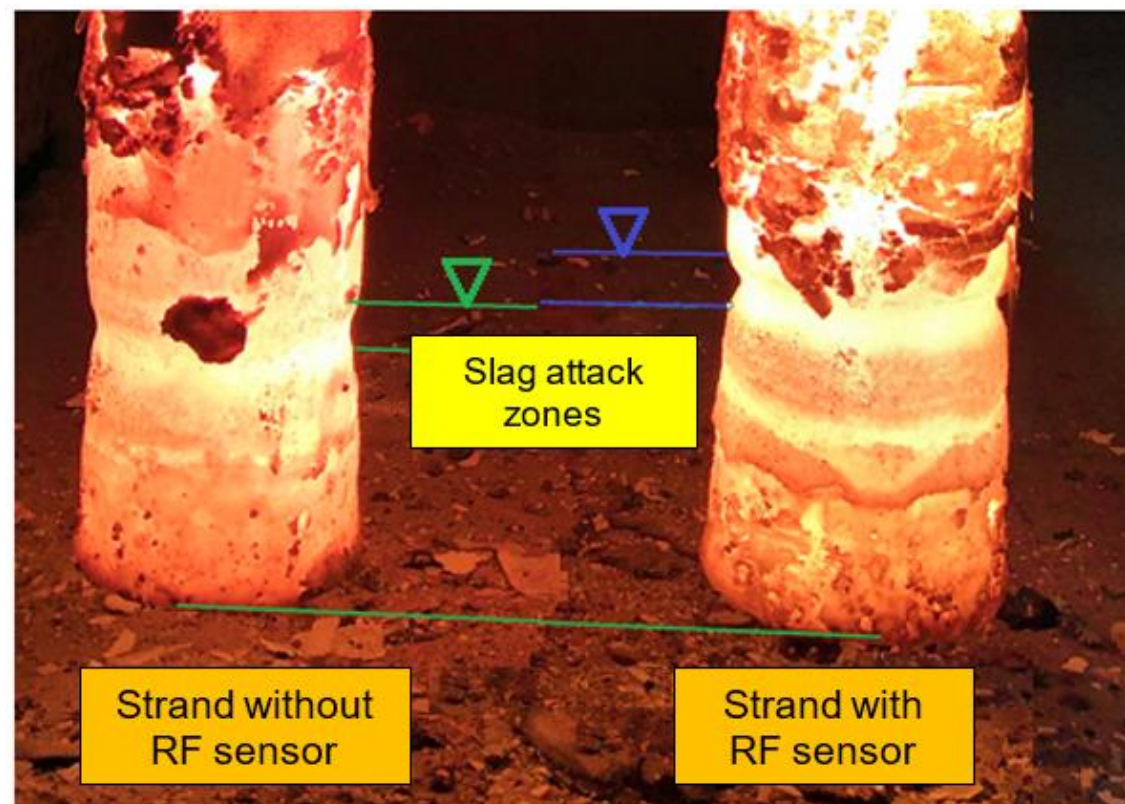
Lack of powder due to clogging of the feeder. The sequence continued by manual powder feeding

Behavior of automatic powder feeders with and without RF sensor



Comparison between the different widths of the slag attack zones on two SEN of two strands without and with RF sensor

Help in respecting the constancy of the steel level in the mold



Comparison of the different immersion depth of two SEN evidenced by the different position of the attachment zones of the slag on two strands without and with RF sensor.

CONCLUSION



The RF sensor can be connected in closed loop with the system of automatic feeding of the mould powder allowing to maintain a uniform and constant thickness of the powder layer for the entire production process and ensuring the best casting conditions for each steel grade product.

Relevant improvements of the quality of as cast long products have been accomplished, in detail in the production of steel grades with high performances are achieved thanks to the stability of the process conditions.

The benefits of the adoption of this sensor can be summarized as follows:

- Better working condition for the lubrication of the mold powder
- Reduction of steel surface re-carburization with minor drag inclusions
- Stabilization of mold heat flux extraction
- Better control on the SEN refractory consumption
- Prevention of the inconveniences in SEN breaking under the meniscus
- Timely information on lack of powder or too much powder in the mould
- Increasing of the mold steel level stability

Thank you for your attention/

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