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New insights from the online LUS grain size measurements

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In a collaborative initiative, an innovative Laser UltraSonic (LUS) device was installed at the SSAB Hot Strip Mill in Borlänge. This measuring device, along with the software for signal processing and evaluation, was developed, constructed, and implemented through a partnership involving SSAB, SWERIM, EMG, and the SMS group. Positioned after the last rolling stand in the finishing mill, the measurement of austenite grain size is taken immediately after rolling.

The LUS measurements were conducted on various steel grades with differing dimensions and process parameters. The calculated process data of the tested strips were sourced from the SMS process models (pass schedule model PSC® and cooling section model CSC) and underwent comprehensive analysis alongside the measured process data and austenite grain size. This analysis encompasses the entire process, beginning with the discharge of slabs from the reheating furnaces, through the roughing mill, coil box, finishing mill, cooling section, and concluding with the downcoiler. Extensive recalculations using the PSC® and CSC were performed to quantify the correlation between the measured austenite grain size and the process conditions of the rolled strips.

The detailed recalculations demonstrate a strong correlation with the measured grain sizes. Based on the results, e.g. variations in the transfer bar thickness were made, leading to a more equal grain size along strip length, which has also a noticeable effect in following cold rolling process.

In the near future, the LUS measurements could be integrated into the Level 2 automation system, enabling the use of austenite grain size within the pass schedule model PSC®, the cooling section model CSC, and the microstructure property model MPM. Consequently, these models could utilize austenite grain size as a setpoint for direct process control in the hot rolling mill, thereby improving the control of product properties and minimizing downgrading.

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