SUCCESS STORY

K1-MET
Competence Center for Excellent Technologies in Advanced Metallurgical and Environmental Process Development

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EXPERIMENTAL SIMULATION OF SURFACE CRACK FORMATION IN CONTINUOUS CASTING

IN PROJECT 3.2, THE IN-SITU MATERIAL CHARACTERIZATION - BENDING (IMC-B) TEST GOT FURTHER DEVELOPED. IT ENABLES INVESTIGATIONS OF THE SUSCEPTIBILITY TO SURFACE CRACK FORMATION UNDER NEARLY CONTINUOUS CASTING CONDITIONS FOR VARIABLE STEEL COMPOSITIONS AND DEFINED PROCESS PARAMETERS.

The prevention of surface damage is an important aspect during the production process of continuous cast products, since the deletion of these defects is associated with high costs. An economical production of high quality products therefore requires an optimal production process. This assumes better knowledge of mechanisms that lead to crack initiation.

Based on the knowledge of previous projects, a new experimental setup for the prediction of surface crack formation in continuous casting was further developed at the Chair of Ferrous Metallurgy at Montanuniversitaet Leoben. In the IMC-B, test a sample of a specific steel composition is casted into a special designed mould. After a defined residual solidification time in the mould, the sample is cooled according to a given cooling strategy. The surface temperature is continuously controlled during the cooling process. At a certain time, an isothermal three-point bending test is carried out. It simulates the stresses and strains during straightening. **Fig.1** shows a flow sheet of the IMC-B test and examples of time-temperature curves for a certain testing sequence.

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Afterwards, the cracks and defects on the samples are detected. A critical strain is defined for each test, which expresses a value for the investigated conditions, leading to first cracks in the sample surface. Since the whole testing sequence is adjusted to parameters of continuous casting machines, it represents a reference value, which can be transferred as a cracking criterion in the continuous casting process.

Critical testing conditions for various process parameters - process digitalisation

During the project period, amongst others, the influence of deformation parameters, temperature, cooling processes and microalloying elements on the formation of surface cracks was determined. Results show that the cause for defect formation is always a combination of several factors. Nonetheless, the mechanisms leading to the damage can be described separately. The definition of critical and non-critical testing parameters enable the steel producer to avoid or support conditions in the continuous casting machine in order to prevent surface cracks on the semi-finished product. This saves costs, process capabilities and lowers the risk for a non-detected defect on a finished hot rolled product.

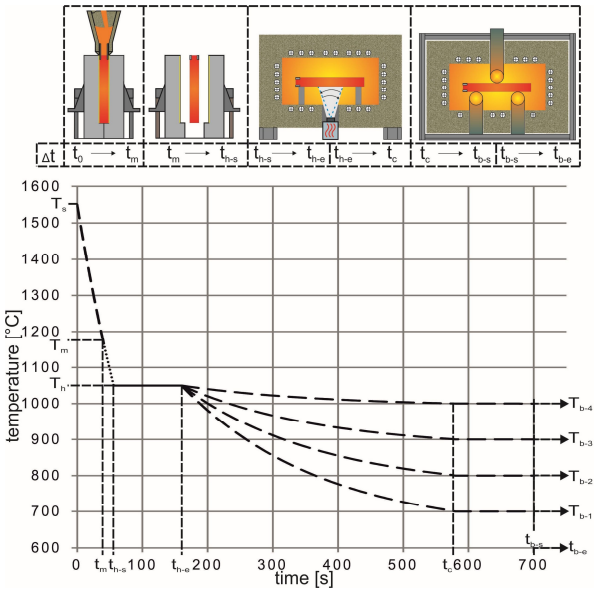

Fig. 1: Flow sheet of the IMC-B test within the significant time periods; examples of time-temperature curves for a testing sequence (Montanuniversitaet Leoben, Ferrous Metallurgy)

The IMC-B test presents a unique benchmark experiment, which is used to avoid critical casting parameters and to enable high quality continuously cast products. It contributes to the digitalisation of the continuous casting process. The goal is an online defect-risk model, which predicts the susceptibility for casting defects to appear and automatically adjusts the casting parameters to less critical conditions in order to prevent damage of the material.

Project coordination (Story)
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