ABSTRACT

Title: *Prediction based component and process optimization*

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The production of casting parts is based on the application of various interrelated (sub-) processes that span the entire chain from melting to heat treatment and continue including processing. Each of these processes is controlled by appropriate control variables. This control is based on the adherence to defined process limits for each control parameter. In this way, the default is for compliance with technical and economic profiles of properties of the produced parts. However, the individual processes and their control parameters are interrelated with each other in a complex manner. There are interactions between different parameters of (partial) processes, so that the ultimate property profile is actually determined by these interactions. However, these are not explicitly considered in the standard process control, for example in the individual control of the individual (sub-) processes.

In a foundry, using modern sensors on machines and in production generates enormous amounts of data. This data contains implicitly the exact knowledge of interaction of parameters processes and their effect on certain properties or property profiles. Limitation is that with the usual commonly employed statistical tools, this knowledge cannot be extracted from the process data.

However, it is possible to identify and represent interrelated patterns and their relationships from this huge amount of data with process-specific prediction software. On this basis, for optimal process settings, decision-making processes can be initiated against defined component properties through an intelligent combination of process rules and process knowledge. The techniques used for the required precise predictions are based on machine learning algorithms and methods from the fields of Predictive Analytics, Predictive Computing and Predictive Modeling.

The presentation describes the basic methodology of prediction based optimization of production processes and component properties. Especially in context of the specific conditions in foundries, the risks, the opportunities and the possibilities of this type of optimization are presented. This is accomplished by performing selected analysis with the software package *EIDOdata* in foundry manufacturing and in the production of steel.

Keywords: Robust Processes, Complex production chains in foundries, Process- and Parameter interaction, Big data analytics, Data problems, implicit process knowledge, machine learning, predictive analytics, knowledge-based process control, Recommendation Systems, prediction based process optimization, self-optimizing processes