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The use of image data in steelmaking –a short guide to promises and pitfalls

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Images are a very powerful tool in monitoring complex processes in industrial settings and indicating relevant events with impact on process quality and stability. The intuitive interpretability of an image is often superior to the extraction of numerical key performance indicators based on multiple data streams from a variety of sensors, but not every relevant process aspect can be directly monitored in form of images, and not every image data stream can receive attention from an operator with the right process experience. Therefore, automatized image processing methods for process surveillance, optimization and control are in high demand. The key challenges for successful image-based process monitoring in the steelmaking industry are inaccessible environments with often rough conditions, high demands on the timing of data acquisition and analyses, and the complex interplay of many factors influencing an outcome of a process. Even after a successful development of image acquisition solutions, the obtained data needs to be evaluated sensibly, and correct conclusions need to be drawn for the process, which might involve further knowledge from process models or experience.

In this contribution, we discuss these important challenges on the example of three instances of image data analysis in steelmaking: the prediction of scrap content and composition on trucks via a combination of optical and LIBS sensors, the evaluation of converter vessel wear based on thermal image acquisition and combination with finite element wear simulations, and the assessment of stirring efficiency and homogenization degree in a Ruhrstahl-Heraeus degassing plant through the combination of image data and multiphase fluid simulations.

Discussing these use cases, we will describe where and how image data can be successfully employed to improve key aspects of industrial processes, what needs to be observed, and which impact can be achieved through these measures.

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