



## DETERMINATION OF THE LIME STANDARD OF LIQUID SLAG WITH LASER-INDUCED BREAKDOWN SPECTROSCOPY

### Task

Laser-induced breakdown spectroscopy (LIBS) shall be used to analyze the LD slag generated in the production of crude steel by the company voestalpine Stahl GmbH in Linz, Austria. The analysis should be conducted in the ladle of slag transporters to determine the lime standard. The slag in the ladle is liquid or partially solidified at the surface at temperatures ranging from 600 °C to about 1300 °C. The measurements should serve to classify the slag so that it can be systematically recycled. The laser measuring device was designed, created and put into operation for automated 24/7 operation.

### Method

Preliminary studies showed that the process is fundamentally suitable and that the analytical characteristics could be achieved at the given boundary conditions. In addition, the process parameters were determined. Great attention had to be placed on the requirements of continuous operation, on the large measuring distances and the heat and dust in process development and in the design and selection of components. The interfaces were selected in close cooperation with the client.

### Result

The measurement runs automatically after the driver of the slag transporter has started it. Here, the LIBS measurement unit adapts to varying filling heights of the slag ladle. To average spatial variations in the composition, the measurement is performed along a line on the slag surface and takes height variations of the surface profile into account. The analysis from the release to the data transfer to the control system lasts less than two minutes. The measuring device runs in 24/7 operation and a total of more than 12,000 measurements have been made in the development and operation phase.

### Applications

The methods and devices developed are suitable for automated analysis of mineral substances in the production process in the most difficult conditions. This way, substances generated in production processes can be classified at an early stage and conveyed to the targeted use.

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*3 Transporter with slag ladle below the measurement site.*

*4 Slag surface during the LIBS analysis.*