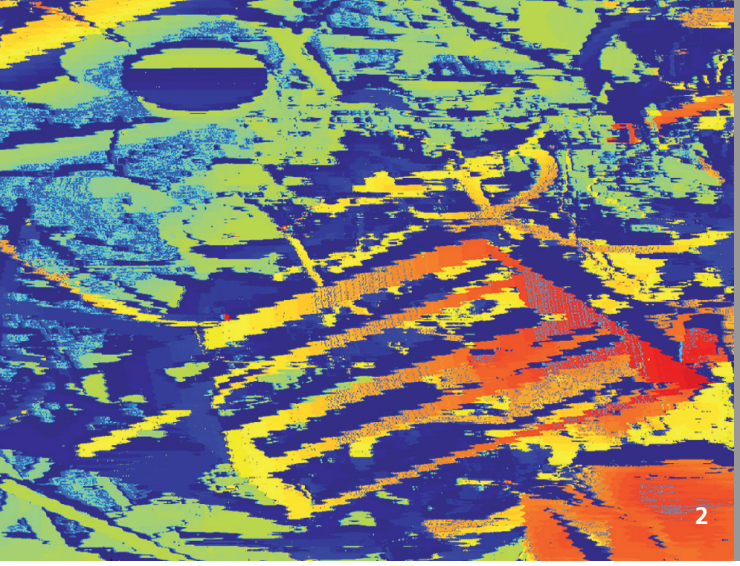

MULTI-ELEMENT ANALYSIS IN MASS STREAMS

Task

Steel can be recycled with metallurgical processes and reused in steel alloys as new. The process to do this is in wide use and treats millions of tons of steel annually. Since the composition of the scrap metal is normally not known and the alloy composition itself has to be defined accurately, the melted steel first has to be purified, e.g. through oxidation of undesired accompanying elements. To ensure stable process control and to save energy, the composition of the scrap metal should be measured as it is charged into an electric arc furnace in a European steel works.

Method

An LIBS analysis system (Laser-Induced Breakdown Spectroscopy) was tested at Fraunhofer ILT and at a steel works. The demonstrator model is arranged over the conveyor system for the scrap metal and measures the composition of the stream continuously. The surface topology is scanned optically and a measuring position determined which enables an accurate LIBS measurement to be made on the surface. From a distance of 900 to 1400 mm, 15 chemical analyses are made per second, distributed over the entire width of the scrap metal flow, whose spectral data are then evaluated fully automatically.

Along with the measurements of the level and the conveyor speed, the total mass of silicon in the melt can be determined and the load can be adapted while a melt is being fed.

Result

The system was tested on over 800 melts at 150 tons each during a six-week measurement campaign. For reasons of comparison, slag samples of the melt were tested in the laboratory as well. The results of the LIBS measurements correlate with those from the laboratory. The inline analysis with the laser measuring system makes it possible for the first time to obtain feedback directly so that the furnace charging can be optimized.

Applications

The process is suitable for multi-element analysis of different materials that are present in mass streams. In addition to analyzing metal scrap, the laser direct analysis can also be used for metallic ore as well as for salts and coal.

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2 False-color image of the profile topology of the scrap metal stream.

3 LIBS plasma in the mass stream.