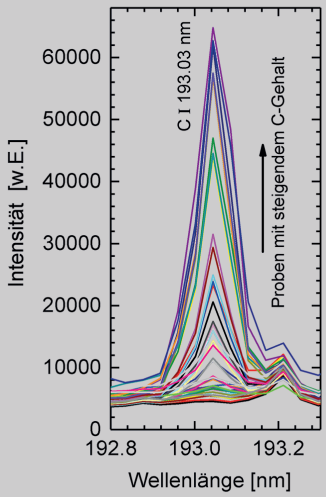
1



2

MOBILE SPECTROSCOPY FOR THE ANALYSIS OF CARBON IN STEEL

Task

To better analyze the elements of metals with mobile analyzers, such as cordless handheld devices, this project aims to develop the process and conceptual design for laser-induced breakdown spectrometry (LIBS) with small, highly integrated components and to investigate its analytical performance in the laboratory. Due to the economic importance and technical challenges, it will mainly focus on detecting carbon in steel. Its goal is to detect carbon down to the range of 0.01 percent, while remaining compact for a handheld device.

Method

In close connection between laser development and measurement technology, the project partners are developing a passive Q-switched laser, the spectral detection and the guidance of the laser and measuring radiation under the specifications for a mobile application. Size, weight and energy management play a decisive role in addition to the achievable analytical performance. Key points of the development are manifold: determining the compromise between these boundary conditions and the conflicting requirements on the spectral resolution, the inert gas atmosphere at the interaction site as well as the duration, sensitivity and reproducibility of the measurements. The parameters of the LIBS detection must be adjusted in such a way that the carbon spectral line is effectively detected and the detection of low content is possible.

Results

In a laboratory setup, carbon in steel can be detected with optimized measurement parameters; the setup's core components are designed for a mobile system. On steel samples with carbon contents in the range of 0.01 percent, the carbon line at 193 nm is detected significantly at a laser repetition rate of 1 kHz.

Applications

Mobile analysis devices for rapid elemental analysis of metals are commonly used in metal production and processing as well as in the recycling industry. Compact, integrable measuring systems also make it possible to continuously monitor production processes or conduct identification tests as well as to inspect incoming raw materials or semi-finished products.

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1 Reference samples of steel with certified carbon content.

2 Spectral line of carbon at 193 nm for a set of reference samples with varying carbon content.

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