Sorting high quality minerals with LIBS

Refractory bricks are high-grade minerals used in industry for all high-temperature processes. In steel, cement or glass production, they are in direct contact with the hot and partly molten product, protecting the furnaces and other aggregates. In these processes, the refractory material is partially consumed and must be replaced after a certain service life. A considerable amount of residual material remains and can be reused for new applications, provided that the material can be separated into pure fractions. Since visual inspection can only be used to identify this refractory material to a very limited extent, automatic sensor-based sorting could significantly increase the amount of material available for reuse.

Efficient sorting with laser-based sensor technology

The laser-induced breakdown spectroscopy (LIBS) method can be used to determine the composition of individual pieces of material on a conveyor belt. In its patented 3D scanning LIBS technology, Fraunhofer ILT combines location-accurate analysis with intelligent automatic positioning of the measurement points. In addition, it evaluates the measurement data obtained using machine learning. The individual components of the material can first be analyzed and then its material assigned to a material class with LIBS.

Recycling instead of mining

In industry, refractory materials are used in many varieties, the mixing of which would lead not only to a loss of quality, but ultimately to a loss of refractory properties. Many types cannot be distinguished with the naked eye; black magnesia-carbon bricks, in particular, are difficult to identify. Thanks to the LIBS process, individual mineral constituents can be both identified and their distribution in the inhomogeneous material captured, a capability that allows the product to be accurately assigned to its material class.

Together, Fraunhofer ILT and its European project partners are developing the entire process chain to implement automatic sorting and high-quality material recycling of used refractory materials in industry, the use of which will contribute to the conservation of natural resources.

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50 mm
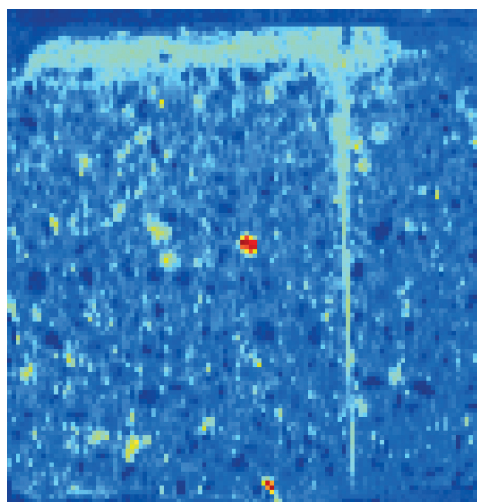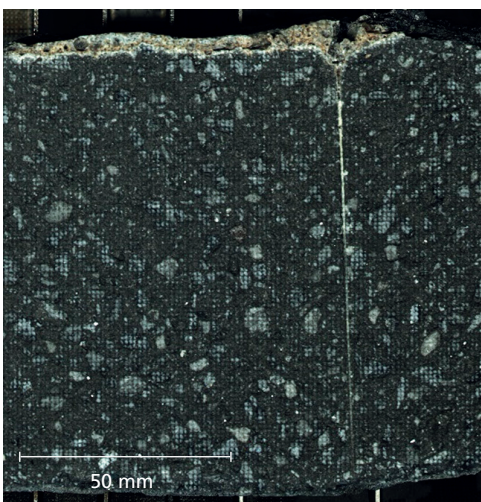
1 Cut surface of a used refractory brick.
2 LIBS measurement: distribution of low (blue), medium (green) and high (red) aluminum contents.