



LIBS SENSOR TECHNOLOGY FOR THE ANALYSIS AND CONTROL OF SCRAP FLOWS FOR METAL RECYCLING

Task

Metals can be recycled as often as required – without any loss of quality – simply by remelting them. Used in a variety of alloys with various alloying elements in specific concentrations, they are produced as such in furnace processes. In contrast, the metal scrap available for recycling is usually widely mixed and only roughly prequalified. In addition, low-quality scrap should increasingly be used in order to increase the recycling rate, which further reduces the metal purity. To process these metals in an energy- and raw material-efficient manner, the industry needs precise knowledge of the chemical composition of the materials. Therefore, a method is needed to determine the chemical composition of metal scrap before it is fed into the furnace.

Method

A three-dimensional scanning laser measurement process is used to analyze the delivered metal scrap and determine the chemical composition of the individual scrap parts. The analysis is performed by laser-induced breakdown spectrometry (LIBS) and provides a large number of multi-element analyses per minute. The composition of the scrap parts is transmitted to the recycling plant's control center so that the furnace can be

charged in a defined manner. Depending on the application, the individual parts are sorted into pure alloys, or entire scrap streams are controlled on the basis of a representative average value of the analysis. Before each measurement, a laser pulse at the measurement location cleans the contaminated parts according to a patented process and exposes the material to be measured. For this purpose, the surface contour of the scrap is recorded by a laser-light section measurement, which provides the 3D coordinates for the laser focus of the LIBS measurement.

Results

In cooperation with industry and research partners, Fraunhofer ILT has developed a universal concept for a measuring device that can analyze both individual scrap parts on conveyor belts and batch loads as a whole. The measuring process has been tested in the laboratory on different materials and will be tested in the further course of the project in various recycling plants for steel, aluminum and lead.

Applications

In addition to evaluating scrap streams, the sensor technology can also be used for sorting mixed metal scrap. However, the LIBS measurement process is not limited to metallic materials; mineral or mixed material streams in the raw materials industry can also be analyzed. The inline measurements map the chemical composition of the material in real time and provide the data basis for process control and management. The work is being carried out as part of the EU project REVaMP under grant number 869882.

Contact

Dr. Volker Sturm, Ext: -154
volker.sturm@ilt.fraunhofer.de

Dr. Cord Fricke-Begemann, Ext: -196
cord.fricke-begemann@ilt.fraunhofer.de

1 LIBS analysis of a stream
of metal parts on a conveyor belt.