LASER-ASSISTED SORTING OF MINERALS

Task

In order to efficiently exploit minerals such as limestone or other minerals and ores, useful rock needs to be separated from any accessory rock during processing. Owing to the large quantities of materials involved, separation must take place in the immediate vicinity of the extraction site. At present, there is no cost-efficient automated process capable of sorting primary raw materials online on the basis of single particles.

Method

As part of a collaborative research project, a laser-assisted sorting process has initially been developed to separate limestone and dolomite. In this process, relatively pure calcium carbonate rocks are separated from rocks that contain undesirably high proportions of magnesium. The process employed to rapidly identify and sort the raw materials is based on a combination of optical geometry measurement and laser-induced breakdown spectroscopy (LIBS). After singularization of the particles, the geometrical characteristics of the material are determined and then laser spectroscopy is used to determine the chemical composition of the single particles. Finally, the sorted material is discharged as two or more fractions in accordance with the sorting decisions that are made online.

Result

A pilot-scale demonstrator has been built to test the process under close-to-real-life conditions. This has shown that laser analysis can determine the composition irrespective of the deposit location, while the analysis was not distorted by adherent dust. In sorting tests with limestone production samples at a conveyor belt speed of 3 m/s, the average MgO content of the useful material was reduced from 4.5 percent to a non-critical figure of 3.6 percent, while reducing the mass by just 13 percent. This result was achieved by directing material containing more than 10 percent MgO to a separate discharge chute.

Applications

In addition to extracting limestone, laser-assisted sorting can also be used for other minerals and ores. The industry-compatible sorting unit currently supports mass throughput of up to 150 t/h, which will in future be increased to 1000 t/h. If individual particles do not need to be sorted, this measuring technique can also be used to characterize a material flow and to control processing.

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3 Characteristic laser-induced plasmas on rock samples.