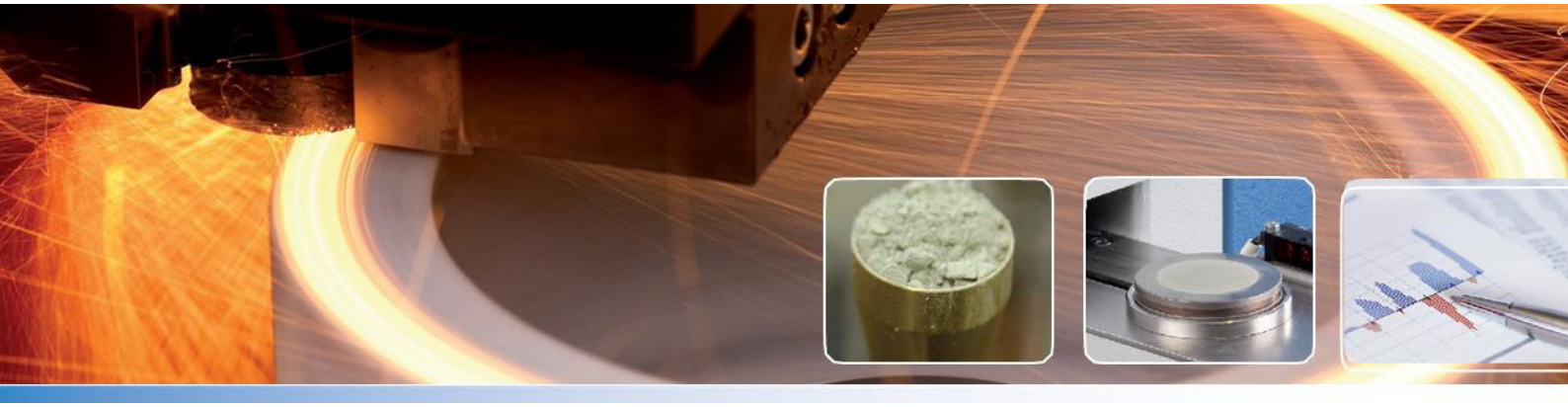

Real-time monitoring of grinding efficiency in disc mills by acceleration measurement

Abstract

In this application note we introduce a novel approach for real-time measurement of the grinding efficiency in laboratory disc mills (patent pending). We demonstrate that efficient grinding is associated with a significant increase in the acceleration variability and decrease of the acceleration magnitude as measured by a 2-d acceleration sensor. This finding was consistent among various disc mills regardless of the mill type or grinding vessel volume. This smart-industry solution enables quantitative monitoring of grinding performance for improved analytical accuracy and reproducibility.

Key words

• **Sensory signal** • **Real time monitoring** • **Grinding** • **Disc mill**

Introduction

We have previously shown that acceleration measurement of the grinding vessel can be used to monitor the wear of the grinding set and the swing aggregate in disc mills. Furthermore, we demonstrated that the method is capable to predict the failure of anchor bolts connecting the drive motor to the swing aggregate. Accordingly, evaluation of the acceleration sensor signal turned out to be an easy and powerful approach for tool condition monitoring (TCM) and predictive maintenance (PdM) of disc mills.

In this application note, we present first data confirming that the acceleration signal can also be applied for monitoring the efficiency of the of the grinding process. Disc mills are used in the laboratory to comminute granular sample material reducing the grain size from usually 1 to 5 mm to 150 µm and below. The eccentric movement of the grinding vessel puts the grinding set inside into circular motion. The sample particles are ground based on shearing, impacting and compression of the material between grinding set, wall of the vessel and among each other. In many instances, the ground material is subsequently pelletized and analyzed by X-ray fluorescence. The grain size distribution following grinding has a significant impact on the XRF results. This so-called particle size effect may cause variances in elemental analysis of more than 30% due to