Processing of samples with a wide range of copper grade within one pulverizer

Assessment of the automatic pulverizing mill HP-MA

Abstract
During copper production the quality control laboratory has to deal with samples of varying copper concentration including copper matte and slags. The automatic pulverizing mill HP-MA provides the possibility to process samples with a wide range of Cu-grade. The integrated sand cleaning function of the vibrating mill HP-MA allows the automatic preparation of different sample types on a single machine without the risk of contamination.

Keywords
• copper matte • copper slag • XRF • contamination • automation

Introduction
The HP-MA is successfully used worldwide for process control at various copper plants. The cleaning function with combined sand and compressed air cleaning was found suitable for processing high grade copper matte (~65 % Cu) and different types of slags:

<table>
<thead>
<tr>
<th>Slag Type</th>
<th>Cu Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Converter slag</td>
<td>&lt;7 % Cu</td>
</tr>
<tr>
<td>CuPb slag</td>
<td>&lt;0.5 % Cu</td>
</tr>
<tr>
<td>Cu slag</td>
<td>&lt;0.9 % Cu</td>
</tr>
</tbody>
</table>

This note will present main parameters of sample preparation and show the capability for processing samples with widely varying grades of copper on a single grinding machine.

Fig.1: The automatic mill HP-MA configured for a combined cleaning with sand and compressed air.
(1) storage for cleaning sand (vol. 1.5 l),
(2) PLC control panel,
(3) cup magazine for batch processing
Sample preparation
For the contamination test a sample amount of 50 g was chosen. The copper matte was ground for 90 seconds with 1400 r/min, while slag samples were ground for 60 seconds at the same speed. The CuPb slag was chosen for the contamination test, because this type has the lowest Cu-content. The interposed sand cleaning was performed at lower speed and with duration of 15 seconds. The sand used for cleaning was normal commercial quartz sand. The cleaning was tested with three different amounts of sand: 30 g, 50 g and 70 g. XRF analyses was carried out using an energy dispersive spectrometer and a standardless method. To roughly estimate the degree of contamination for each sample the output loss was determined after milling.

Results
The loss of output depended on the Cu-content of the sample. Accordingly, copper matte (~65 % Cu) exhibited the biggest loss with about 11 % of the input weight. Among the different slag types, the average loss was highest for the converter slag (3 % loss). A detailed summarization is given in table 1 below.

XRF analysis shows that the Cu-content of CuPb slags was below the limit of 0.5 % in all three test scenarios (Tab.2). Picture 2 shows the peak intensity compared to the copper matte and a contaminated sample milled without interposing sand cleaning (30 g). The results clearly revealed that contamination was avoided by using the sand cleaning option in combination with compressed air.

Conclusion
The mill HP-MA is able to process different sample types with a wide range of copper grade without significant contamination. The implementation of a blind sample will further minimize the cross contamination. Therefore, the HP-MA is a reliable pulverizing mill for processing copper samples for process control.