

## Comparing the Effectiveness of the Crushing and Grinding Route of Comminution to That of the Mine to Mill Route in Terms of the Percentage of Middlings Present in Processed Lead-Zinc Ore Samples

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**Abstract :** The presence of gangue particles in recovered metal concentrates has been a serious challenge to ore dressing engineers. Middlings lower the quality of concentrates, and in most cases, drastically affect the smelter terms, owing to exorbitant amounts paid by Mineral Processing industries as treatment charge. Models which encourage optimization of liberation operations have been utilized in most ore beneficiation industries to reduce the presence of locked particles in valuable concentrates. Moreover, methods such as incorporation of regrind mills, scavenger, rougher and cleaner cells, to the milling and flotation plants has been widely employed to tackle these concerns, and to optimize the grade-recovery relationship of metal concentrates. This work compared the crushing and grinding method of liberation, to the mine to mill route, by evaluating the proportion of middlings present in selectively processed complex Pb-Zn ore samples. To establish the effect of size reduction operations on the percentage of locked particles present in recovered concentrates, two similar samples of complex Pb- Zn ores were processed. Following blasting operation, the first ore sample was ground directly in a ball mill (Mine to Mill Route of Comminution), while the other sample was manually crushed, and subsequently ground in the ball mill (Crushing and Grinding Route of Comminution). The two samples were separately sieved in a mesh to obtain the desired representative particle sizes. An equal amount of each sample that would be processed in the flotation circuit was then obtained with the aid of a weighing balance. These weighed fine particles were simultaneously processed in the flotation circuit using the selective flotation technique. Sodium cyanide, Methyl isobutyl carbinol, Sodium ethyl xanthate, Copper sulphate, Sodium hydroxide, Lime and Isopropyl xanthate, were the reagents used to effect differential flotation of the two ore samples. Analysis and calculations showed that the degree of liberation obtained for the ore sample which went through the conventional crushing and grinding route of comminution, was higher than that of the directly milled run off mine (ROM) ore. Similarly, the proportion of middlings obtained from the separated galena (PbS) and sphalerite (ZnS) concentrates, were lower for the crushed and ground ore sample. A concise data which proved that the mine to mill method of size reduction is not the most ideal technique for the recovery of quality metal concentrates has been established.

**Keywords :** comminution, degree of liberation, middlings, mine to mill

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