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Mineral Preparation Using Rod Mill for Mineral Galena Characterization

Riria Zendy Mirahati[1], Yasmina Amalia[2], Mochamad Juliyanto[3], Lintang Larasati Adi Putri[4]

[1)] Metallurgical Engineering Study Program – Mining Engineering Department, Faculty of mineral engineering, UPN "Veteran" Yogyakarta, Indonesia

Abstact

Galena mineral preparation was carried out for mineral characterization. The mineral characterization carried out included XRD (X-Ray Diffraction), XRF (X-Ray Fluorescence), SEM-EDS (Scanning Electron Microscope-Energy Dispersive X-Ray). The preparation of galena minerals begins with the process of reducing the grain size including crushing and grinding. The results of crushing and grinding are then separated based on grain size using a sieve or siever to get a grain size of -200 mesh. The grinding process using a rod mill needs to be timed, so that the results are not too fine which is causing the recovery in the mineral concentration process to be low.

Keywords: Galena mineral, mineral preparation, crushing, grinding, grain size

INTRODUCTION

The stages of galena mineral processing include ore characterization, comminution, grain size grouping, and concentration. The comminution process includes crushing and grinding. The grouping of the grain size on a laboratory scale, better known by the term sieving. The concentration process can be carried out by several methods, namely hand sorting, heavy medium separation, concentration of gravity, magnetic and electromagnetic separators, and flotation. Selection methods used bases that make up the mineral composition of ore or ore as well as physical and chemical properties of minerals contained in the ore. Acquisition or recovery of minerals will produce the optimal value when done with proper mineral preparation before the concentration process is done. The activity is in the form of seed characterization, to find out what minerals make up the ore.

The ore obtained from the field is usually not directly in the form of a uniform grain size, but in the form of lumps. The lumps are then subjected to a comminution process, including the crushing and grinding processes. Crushing of lumps using a jaw crusher, while grinding using a rod mill. Results of crushing and grinding subsequent separation by grain size or sizing to obtain mineral grain size -200 mesh. A tool for separating minerals based on grain size using a sieve. After all the comminution and sizing processes are carried out, the ore characterization is carried out, in the form of XRD (X-Ray Diffraction), XRF (X-Ray Fluorescence), SEM-EDS (Scanning Electron Microscope-Energy Dispersive X-Ray). The results of the mineral characterization are then used as the basis for selecting the concentration method for galena mineral processing.

METHODOLOGY

The sample of galena that has been used comes from Wonogiri, Central Java, and then brought to the Mineral Processing Laboratory of the Department of Mining Engineering, Faculty of Mineral Technology, Universitas Pembangunan Nasional "Veteran" Yogyakarta for research. The galena mineral used in this study can be seen in Figure 1. The size of the galena mineral in the form of lumps is then reduced by using

Corresponding author:
ririazendymirahati@upnyk.ac.id
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a hammer to reduce the grain size, which can be seen in Figure 2. This is so that the galena mineral can enter the jaw crusher. The reduced sample is then weighed, the weighing process can be seen in Figure 3.

Figure 1. Mineral Galena

Figure 2. The process of reducing mineral grain size manually

Figure 3. Galena sample weighing

Minerals that have been reduced manually are then further reduced to grain size, the grain size reduction process is carried out twice (primary and secondary). The process of reducing grain size in the first stage (primary) using a jaw crusher, can be seen in Figure 4. The process of reducing grain size using a jaw crusher is known as crushing. The results of the grain size reduction process using a jaw crusher are then carried out with a grain size grouping process, which can be seen in Figure 4. The grain size grouping process using a hanging sieve or siever can be seen in Figure 5. The sieves or sieves used are 48, 65, 100, 150, 200 mesh. The purpose is to group grain sizes, so that the process of reducing the grain size in the second stage (secondary) is not too fine. The grain size that is too fine results in the formation of lumps at the concentration stage, so that the recovery will be less.

Figure 4. The process of reducing grain size using a jaw crusher

Figure 5. The process of grouping grains using a hanging sieve

The secondary stage process of reducing the grain size using a rod mill. Rod mill uses steel rods to grind the mineral galena into smaller sizes. The feed that enters the rod mill comes from the results of the jaw crusher which has been carried out in the sieving stage. The process of reducing grain size in the second stage is commonly known as grinding. The grinding process using a rod mill can be seen in Figure 6. The process that occurs in the rod mill is that steel rods hit the mineral galena so that there is friction and collisions between the steel rods with minerals and minerals with minerals when the mill rotates. The collision between steel rods with minerals and minerals with minerals causes large grain sizes to become smaller. The factors that influence the success of the grain size reduction process are the number of steel bars, the length of time the rod mill rotates, the hardness of minerals, and the material of the grinding media (grinder rods).

Figure 6. The process of reducing grain size using a rod mill

RESULTS AND DISCUSSION

The length of time grinding 10 minutes. The crushed minerals are then sieved. The goal is to avoid a size that is too fine or smaller than 200 mesh. Data on the results of mineral grinding for 10 minutes after sieving can be seen in Table 1; Table 2; Figure 7 and Figure 8.

Table 1. Sieving Results after Going through the Grinding Stages

Sample	Weight recovery (grams) of each size in mesh						Quantity
	+48	-48+65	-65+100	-100+150	-150+200	-200	(gram)
I	500	130	70	90	45	160	995
II	605	35	50	65	40	185	980
III	800	40	30	40	15	85	1010
IV	770	35	25	35	25	85	975
V	840	30	20	30	15	70	1005
VI	860	20	20	20	20	50	990
VII	750	55	40	40	30	90	1005
VIII	800	80	60	70	40	100	1150
Quantity	**5925**	**425**	**315**	**390**	**230**	**825**	**8110**
Prosentase (%)	73,06	5,24	3,88	4,81	2,84	10,17	

Table 2. Sieving Results after Going through the Grinding Stages

Sample	Weight recovery (grams) of each size in mesh						Quantity
	+48	-48+65	-65+100	-100+150	-150+200	-200	(gram)
I	3390	170	115	100	80	180	4035
Prosentase (%)	84,01	4,21	2,85	2,48	1,98	4,46	

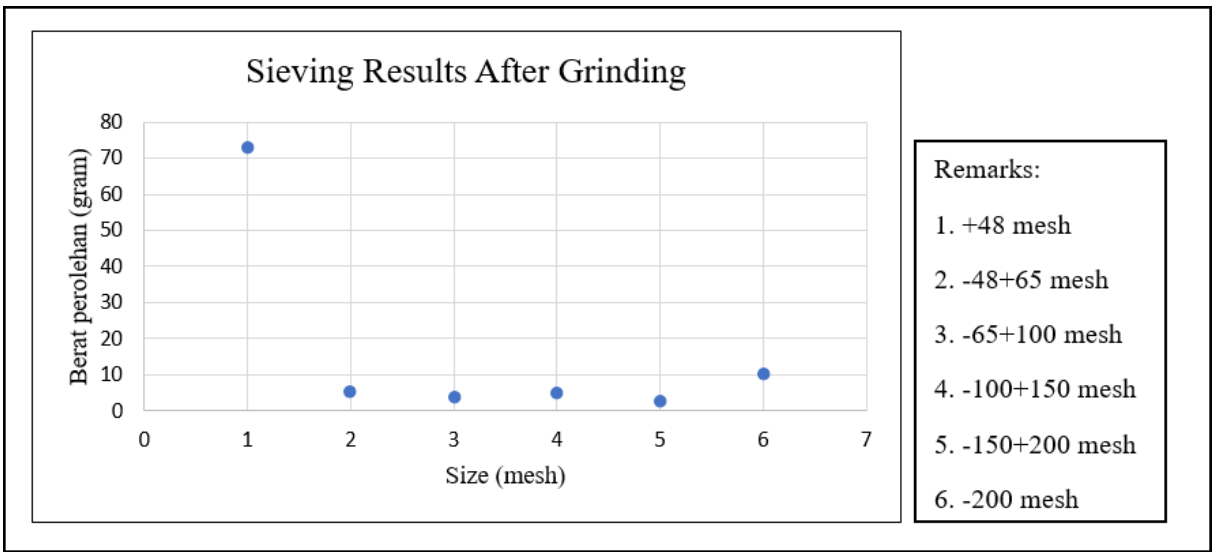

Figure 7. Sieving Results after Grinding Stages

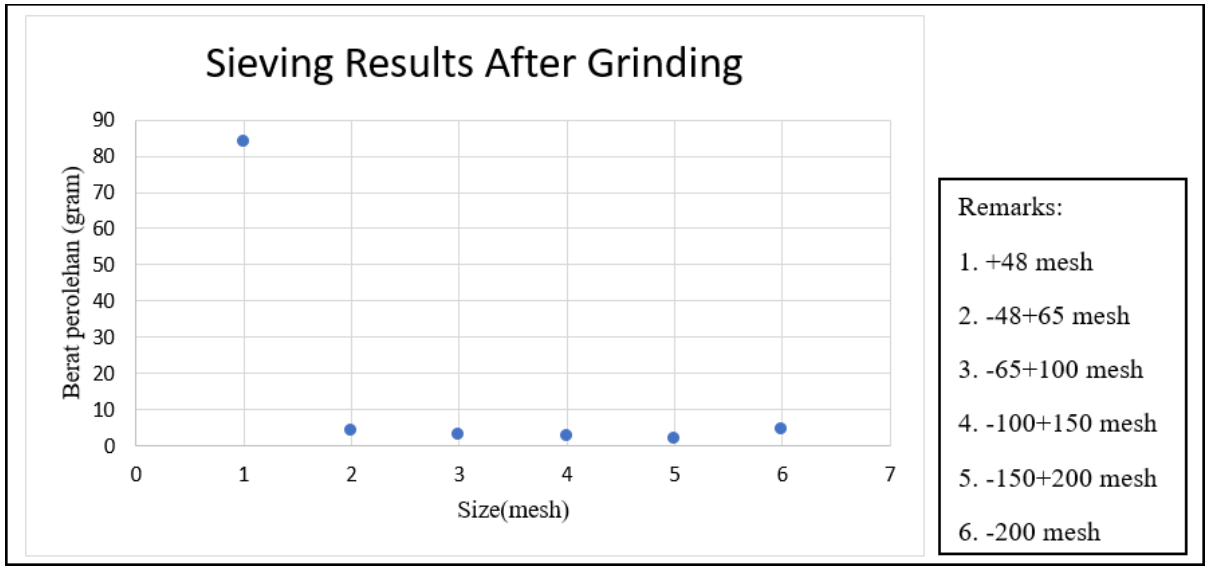

Figure 8. Sieving Results after Going through the Grinding Stages

Based on Figure 7 and Figure 8, the results of grinding galena minerals for 10 minutes after grouping the grain size using a seiver obtained +48 mesh of 73.06 % and 84.01 %, respectively; -48+65 mesh by 5.24% and 4.21%; -65+100 mesh by 3.88% and 2.85%; -100+150 mesh of 4.81% and 2.48%; -150+200 mesh by 2.84% and 1.98%; -200 mesh of 10.17% and 4.46%. The highest recovery is at grain sizes of more than 48 mesh, then at sizes smaller than 200 mesh. Grain size -48+65 mesh; -65+100 mesh; -100+150 mesh; and -150+200 mesh have relatively the same number. Galena mineral recovered in grain sizes of more than 48 mesh showed high recovery due to less grinding time. The grinding time is not long enough so that the grain size is still coarse, so additional grinding time is needed.

In this study, the grain size of the mineral galena is required for mineral characterization before the concentration process in the form of flotation is carried out. Mineral characterization includes XRD (X-Ray Diffraction), XRF (X-Ray Fluorescence), SEM-EDS (Scanning Electron Microscope-Energy Dispersive X-Ray). XRD (X-Ray Diffraction) was tested to determine the compounds present in the ore, while XRF (X-Ray Fluorescence) was to determine the elements contained in it. SEM-EDS (Scanning Electron Microscope-Energy Dispersive X-Ray) was performed to analyze the topography or morphology of ore samples. The weight required for each test is 1 (one) gram of mineral at a size of -200 mesh. This as a basis for grinding time for 10 minutes can already represent the need for galena minerals to be tested for mineral characterization.

CONCLUSION

The maximum recovery or grinding yield of galena is in the size of +48 mesh or greater than 48 mesh, which are 73.06 % and 84.01 %, respectively. The galena mineral preparation process for the characterization of XRD (X-Ray Diffraction), XRF (X-Ray Diffraction), SEM-EDS (Scanning Electron Microscope-Energy Dispersive X-Ray) minerals requires additional galena mineral grinding time, so that the grain size is not too large at +48 mesh. In addition, it is necessary to find the optimum time for the galena mineral grinding process so that there are not many minerals in the size of +48 mesh and –200 mesh.

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