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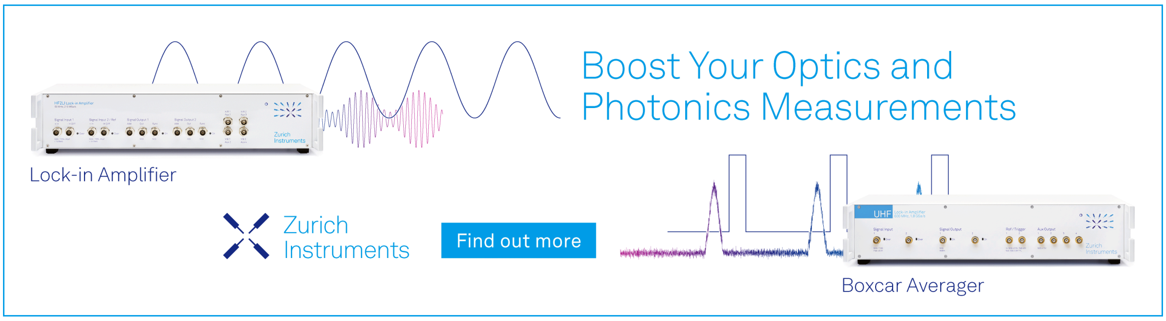

The Effect of H_2SO_4 Concentration and Time on The Sphalerite Leaching Process

Riskaviana Kurniawati [a)], Wiwik Dahani, Subandrio, Mixsindo Korra Herdyanti, Imanuel Purba

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Abstract. Galena is frequently found in association with other sulphide minerals such as sphalerite and pyrite. The pyrometallurgical methods, is commonly used for zinc recovery and requires high temperatures, resulting in heavy metal pollution and SO_2, making it unsuitable for the environment. In this study, the use of H_2SO_4 without an oxidant for direct leaching of sphalerite concentrate was investigated. The sphalerite concentrate (200 mesh) was roasted for 3 hours at 700°C to reduce the sulphur content in the sample. Following that, leaching was performed using a sulfuric acid solution with a concentration range of 1-6mol/L for 1-5 hours. The zinc levels in the leached solution were determined using XRF (X-RayFluorescence) and SEM (Scanning Electron Microscopy). Before the leaching process, the particles of zinc sulphide concentrate have a clear surface and are roughly the same shape and size. The micrographs of the leaching residues show a progressive increase in the roughness of the solid as well as an increase in the amount of elemental sulphur covering the particle surfaces after the leaching process. The presence of sulfuric acid is clearly important in the leaching process, as zinc extraction rate increased with increasing sulfuric acid concentration, but only up to 3 mol/L. The highest zinc extraction, 99.17%, was obtained at 2 mol/L H_2SO_4 after 3 hours.

INTRODUCTION

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Galena is frequently found in association with other sulphide minerals such as sphalerite (ZnS) and pyrite (FeS_2). Zinc exists primarily in the earth's crust as a sulphide, and sphalerite is most important ore. Flotation has been extensively used to separate galena and sphalerite. Zinc is concentrated using froth flotation methods due to the low solubility of zinc sulphides in acid media[6]. Flotation is the most common and commercial technique for processing nonferrous oxide minerals, as well as sulfidation with alkali metal sulphides with the addition of cationic collectors for zinc recovery. Because of the presence of adsorbed sulphide ions, the hydrophilicity of the mineral surface decreases after sulfidation[7]. However, it is less effective for zinc recovery by conventional flotation when the zinc is amorphous, such as zinc in lead slag smelting [1].

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TABLE 1. Composition of major elements of the concentrate

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RESULT AND DISCUSSION

The X-ray diffraction (XRD) pattern for the sphalerite concentrate is shown in Figure 1. The main compound identified was ZnS, as expected, but there were also some PbS and SiO_2 detected.

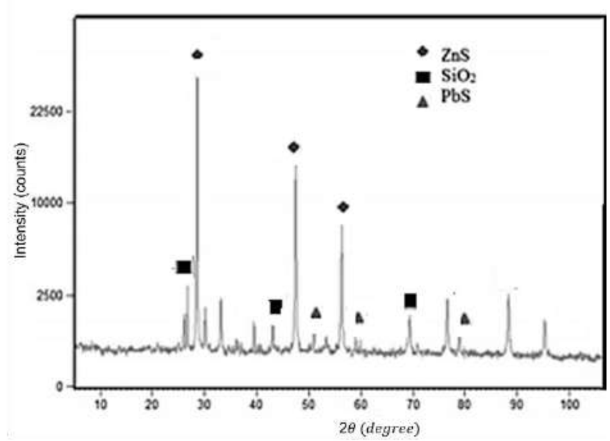

FIGURE 1. Diffractogram XRD of sphalerite concentrate

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$$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2 + \text{heat}$$

By varying the sulphuric acid concentration from 1 to 6 mol/L at 27±2°C, a series experiment was carried out to evaluate the effect of acid concentration on zinc dissolution efficiency. The results, as shown in the figure 2, show that the presence of sulfuric acid is clearly important in the leaching process, as zinc extraction rate increased with increasing sulfuric acid concentration, but only up to 3 mol/L.

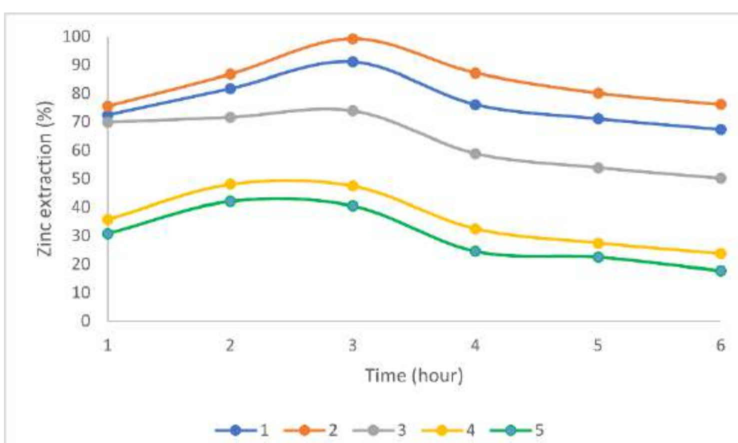

FIGURE 2. Effect of sulfuric acid concentration on zinc extraction

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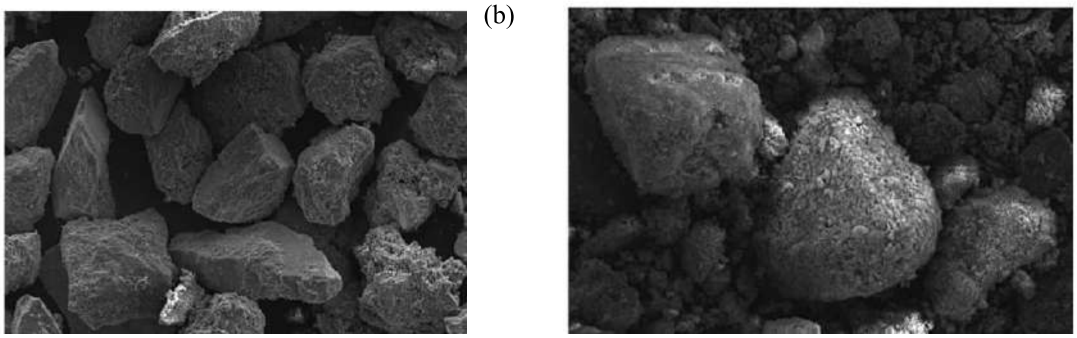
$$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2 + \text{heat}$$

The zinc extraction rate decreased as sulfuric acid concentrations increased. This is consistent with the results of [13], who used ozone as an oxidant in the leaching of sphalerite concentrate. The amount of dissolved ozone decreasedas the acid concentration increased. Because sulfuric acid and ozone both play important roles in zinc dissolution, it is critical to achieve an optimal balance of acid concentration and ozone solubility to maximize leaching rate. In this study, adds information about the leaching of sphalerite concentrate without oxidants, though the time required is longer than with oxidants.

Figure 3 shows the morphology of the zinc sulphide concentrates before and after leaching using SEM. Before the leaching process, the particles of zinc sulphide concentrate have a clear surface and are roughly the same shape and size (a). The micrographs of the leaching residues show a progressive increase in the roughness of the solid as well asan increase in the amount of elemental sulphur covering the particle surfaces after the leaching process (b).

(a) (b)



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by Wiwik Dahani FTKE

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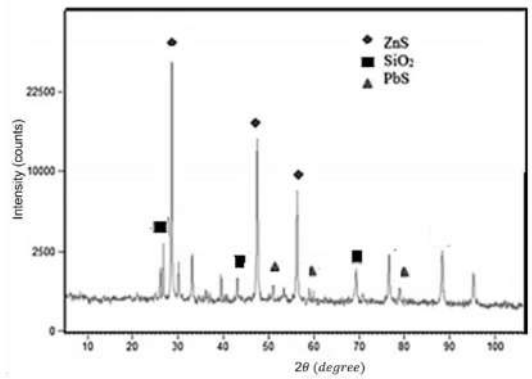

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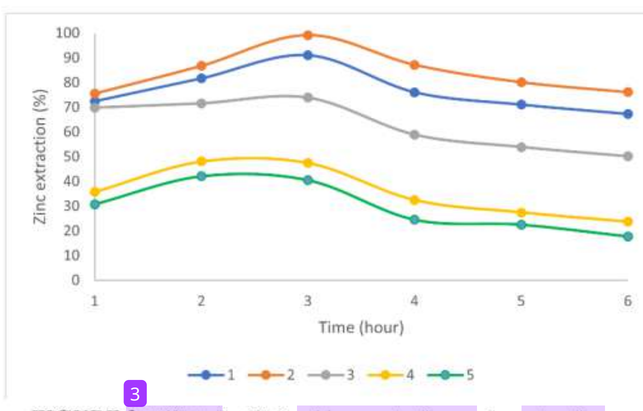

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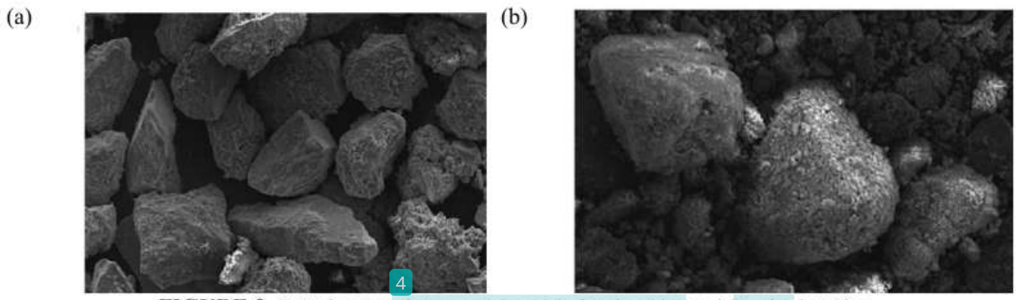

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