Identification of mineral and element of Slag Nickel from PT. Vale Sorowako

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Abstract. We report the mineral and element analysis of Slag Nickel that produced from nickel smelter at the PT. Vale Sorowako. The sample were directly collected from the mining site and crushed until it become powder. The element analysis performed by X-Ray Fluorescence (XRF) and the mineral identification made by X-ray diffraction (XRD). The XRF data showed that the Slag Nickel contains Fe (79.72 %), Si (10.8 %), Mn (2.23%), and Ni (2.04%). The semi-quantitative analysis of XRD pattern indicated that the main minerals in the slag nickel are hematite (Fe_3O_4) and silica (SiO_2). There are Those data reveal that slag nickel still contains many valuable elements which have potential application for advanced technology. Further research is needed to extract those element or mineral from slag nickel.

1. Introduction

The nickel mining in Sorowako, Luwu Timur has already operated since 1968 [1]. The nickel extraction was done by melting the laterite ore in smelter which separate nickel matte and slag nickel. The matte is exported but slag throw away which become one problem to the environment. The slag nickel production could be reach 4.6 million each year [2]. Some of this slag is used for road constructions [2,3].

On the other hand, the material for advanced technology such as magnetic storage, energy storage needs to be available in large amount to realize the industrial needs [4]. Such as materials can be provided from large amount of nickel slag. The Iron (Fe) is one of the most important elements in magnetic storage and also in battery materials which can be found in slag nickel. The extraction of Fe from slag nickel required the knowledge of amount of this element and mineral in slag nickel [5]. In this paper, we report our first step of our research activity on slag nickel by identify its element and mineral by using X-Ray fluorescence (XRF) and X-Ray diffraction (XRD) [6].

2. Method

The slag nickel from slag disposal site was grinded to become powder. The powder then washed by pure water to remove dust and dried to remove water. The dried powder was sent to the Laboratorium *Difraksi Research Center* LPPM ITS for XRF and XRD measurements. The element percentage was acquired from XRF and the matching peak of XRD pattern was conducted to identify the mineral and estimate its percentage by using software MATCH [7].

3. Result and Discussion

3.1. XRF Measurement

Table 3.1 showed the XRF measurement result of slag nickel.

Elements	Weigh percentage (wt%)
Fe	79,72
Si	10,8
Cr	3,14
Mn	2,23
Ni	2,04
Ca	0,74
S	0,56
Rb	0,44
Sc	0,014
Zn	0,14
La	0,09
Re	0,2

The XRF measurement results is shown in table 3.1. The largest amount of element is Fe (79.72%) which make slag have potential for advanced technology application. The Fe which one of magnetic ion can be used as magnetic storage or electromagnetic absorber application which depend on crystal structure which can be adjust by engineering process. Recently, the energy issue is become global issue. One of that issue is energy storage. The Li-ion battery technology is promising technology to solve the issues especially for the electric vehicle. This technology is still very expensive. The main component of the battery is cathode. The $LiFePO_4$ is one the mainly used material as cathode [8]. As we can see this material is contain Fe which can be extracted from slag nickel.

3.2. XRD Pattern

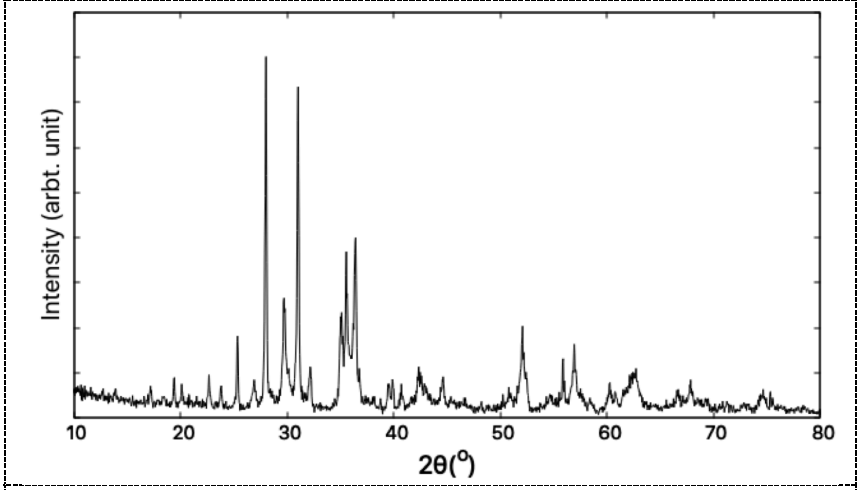

Figure 1. The XRD Pattern of slag nickel.

Figure 1 shows XRD pattern of slag nickel which analysis by MATCH!. We identify the mineral in the slag based on the XRF results. The search and match results gave that the main peak in this sample were identified as hematite (Fe_3O_4) and silica (SiO_2). We perform the semi-quantitative analysis by comparing the high of each peak. The amount of Fe_3O_4 is 59 % and the SiO_2 is 41%. This knowledge can used as basis to determine the processing technology for further research. Because Fe_3O_4 is magnetic mineral

and SiO_2 is non-magnetic material [9], the magnetic separation can be used to extract the Fe_3O_4 which we report in separated paper.

4. Conclusion

We identify the element and mineral in slag nickel. The significant amount element was Fe (79.72 %), Si (10.8 %), Mn (2.23%), and Ni (2.04%). The large amount of Fe made the slag nickel still valuable and potential for the advanced technology application. The XRD pattern shows that the minerals in slag are (Fe_3O_4) and silica (SiO_2). This information will be very valuable for further research to extract element for the special purposes.

5. Acknowledgments

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