

# XRD and XRF Characterization of White Sand from Sambera Village, East Kalimantan, Indonesia

*by* Mohammad Lutfi

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# XRD and XRF Characterization of White Sand from Sambera Village, East Kalimantan, Indonesia

Arief Muliawan<sup>1</sup>, Mardanius Sali<sup>2</sup>, Mustakyudin<sup>2</sup>, Mohammad Lutfi<sup>3</sup>

<sup>1</sup>Department of Electrical Engineering, Sekolah Tinggi Teknologi Bontang, 75313, Indonesia

<sup>2</sup>Department of Mechanical Engineering, Universitas Trunajaya Bontang, 75311, Indonesia

<sup>3</sup>Department of Petroleum Engineering, STT MIGAS, Balikpapan, 76127, Indonesia

Email: ariefstitek@gmail.com

**Abstract.** Characteristic of sand at Sambera village based on crystallography using X-ray diffraction and X-ray fluorescence methods was discussed in this article. This research aims to determine the concentration of quartz based on two specimens obtained from two different places at Sambera village. The metal test on quartz sand with XRD method (X-Ray 0.15406 nm) revealed that the scatter angle at  $2\theta$  are  $26.7321^\circ$  and  $26.7313^\circ$  with crystal width of each location are 1.81085 nm and 1.03421 nm. While the XRF test revealed that the concentration of quartz are 79.1 % and 79.5 %. The Aluminium concentration are 14.9 % and 15.2 % respectively. The result revealed that the sand of Sambera village has potential to be used as quartz material and aluminum.

**Keywords:** XRD, XRF, quartz material, and Sambera village

## 1. Introduction

Quartz sand is one of the abundant minerals in Indonesia. It has a major component of  $\text{SiO}_2$  in which silica atoms are composed of tetrahedron units with silica atoms as centers with four oxygen atoms attached to the angle of the tetrahedron [1]. Quartz sand in Indonesia contains much of the silica that ranges from 60-98% in the form of  $\text{SiO}_2$  with the impurities of  $\text{Al}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{CaO}$ ,  $\text{TiO}_2$ ,  $\text{NaO}$ , and  $\text{K}_2\text{O}$  [2]. Therefore, the research related to the tests of sand as potential resource development [3] and waste sand testing [4] needs to be conducted.

The abundant amount of sand at Sambera village currently used as building material. The color of Sand in these area is white, which is suspected that it is quartz sand. The availability of abundant quartz sand can be further processed as nanomaterial with distinctive characteristics [5]. Purification of quartz sand into nanosilika can be done with acids [6] and bases [7]. It can be processed into a smart material [8, 9, 10].

This research aims to determine X-Ray Diffraction (XRD) and X-Ray Fluorescence (XRF) characterization of white sand from Sambera village, East Kalimantan, Indonesia, where XRD was used to determine the crystallographic characteristics and white sand composition was determined by using XRF [11, 12]. Furthermore, the expected results can determine the type of atom in the crystal and its size.

## 2. Material and Method

XRD and XRF tests were conducted to obtain characteristics of sand using software at Advanced Mineral and Materials Laboratory of State University of Malang (Faculty of Mathematics and Natural Sciences). This research was conducted with several stages, namely: (1) The specimens were collected at Sambera village at two different locations with the specimens at two adjacent sites approximately 500 meters between one to another. (2) Each specimen is then washed with clean water and then dried. (3) each specimen was sieved with a 70 mesh. (4) Testing and analysis were conducted by setting voltage of 40 kV with 30 mA for XRD and voltage of 20 kV with 160  $\mu$ A. Shooting angles ranging from 10-90 degrees with time step is 0.7 second and scanning speed is continuously. (5) Specimens were tested and analyzed using XRF method, where XRF is set at a voltage of 20 kV with 160  $\mu$ A.

## 3. Results and Discussion

### 3.1. XRD analysis

The XRD results of Sambera sand samples are shown in Fig. 1 and Fig.2. There were 23 peaks detected at Sambera sand of sample 1. The distance between atoms in units of cells (d) is 0.11136 -0.71462 nm. The total peak value of FWHM is 6,158, this shows the degree of crystallography. The size of the sample 1 of Sambera sand crystal is between 0.13708 nm and 2.51266 nm. The pattern of the absorption 100% of quartz ( $\text{SiO}_2$ ) lies at angle of  $2\theta=26,7321$  with a crystalline size of 1,81085 nm.

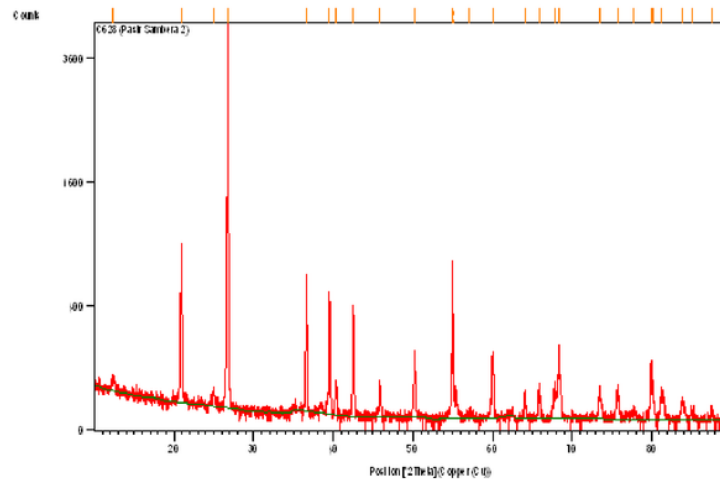


Figure 1. XRD result of Sambera sand for sample 1

There were 23 peaks detected at Sambera sand of sample 2. The distance between atoms in units of cells (d) ranged from 0,11528 to 0,71400 nm. The total peak value of FWHM is 4,907 nm, this shows

the degree of crystallography. The size of the sample 2 of Sambera sand crystal ranged from 0,18831 nm to 2,55244 nm. The absorption pattern 100% of quartz (SiO<sub>2</sub>) lies at angle of 2θ=26,7313 with a crystalline size of 1,03421 nm.

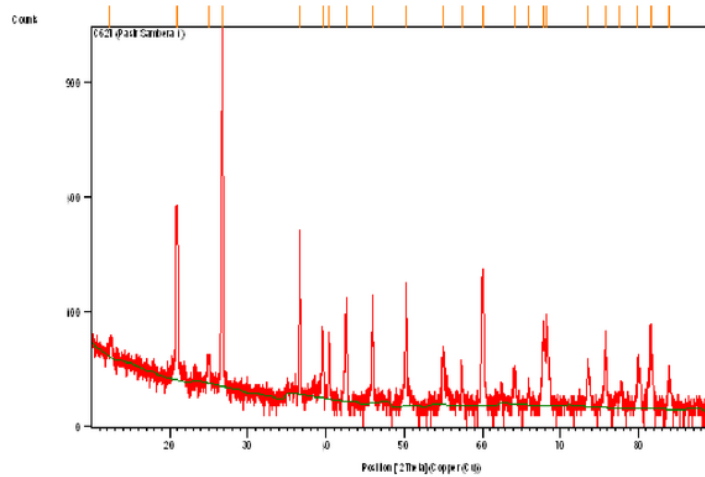


Figure 2 XRD result of Sambera sand for sample 2

### 3.2 XRF analysis

XRF was conducted to determine the chemical composition of minerals at Sambera sand. The data given in Table 1 show that alumina and silica oxide are present in large amounts, while other minerals are present in small amounts.

Table 1 Chemical analysis of Sambera sand

Chemical composition	Weight (%)	
	Sample 1	Sample 2
SiO <sub>2</sub>	79,1	79,5
Al <sub>2</sub> O <sub>3</sub>	14,9	15,2
K <sub>2</sub> O	2,16	1,98
CaO	1,2	0,88
TiO <sub>2</sub>	1,18	1,08
Fe <sub>2</sub> O <sub>3</sub>	1,05	0,95

Table 1 shows the presence of large amounts of Al<sub>2</sub>O<sub>3</sub> which indicating Sambera sand is clay [13].

### 4. Conclusions

The results of Sambera sand extraction using XRD and XRF revealed that the largest content of Sambera sand is quartz. It was detected at the scatter angle of 26.73 with crystal size ranged from 1.034 nm to 1.810 nm, concentration of quartz ranged from 79.1% to 79.5%, and alumina ranged from 14.9% to 15.2%. The results revealed that Sambera sand can be used as a material of quartz and alumina.

## 5. Acknowledgement

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