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SUITABILITY OF CLAY FROM BIDA BASIN, NIGER STATE FOR PRODUCTION OF PORCELAIN INSULATORS

*Dutsun, A.M[1], Abubakre, O.K[1], Muriana, R.A[1], Abdullahi, A.A[2], Emenu, A.U[3] & Taidi, I.B[4]
[1]Materials and Metallurgical Engineering Department, Federal University of Technology, PMB 65 Minna Niger State, Nigeria
[2]Mechanical Engineering Department, Federal University of Technology, PMB 65 Minna Niger State, Nigeria
[3]Chemical Engineering Department, Federal University of Technology, PMB 65 Minna Niger State, Nigeria
[4] Niger State Ministry of Mineral Resources, Minna Niger State, Nigeria
*Corresponding author email:abdullahdutsun@gmail.com +2348066546806

ABSTRACT

Clay from Sakpe deposit within Bida basin was analysed using XRF, XRD, SEM, physico-mechanical and electrical insulation methods. The chemical analysis result of the clay shows high values of SiO_2 (55.73%), Al_2O_3 (29.65%), Fe_2O_3 (0.92 %) respectively and are kaolinitic in nature. It was found to have good physical and mechanical properties at a maximum of 41MPa of cold crushing strength, flexural strength of 9.47MPa, elastic modulus of 460.36MPa. This composition was found to be within standard requirements. The electrical properties were observed to be at 0.65GΩ and 26kV/mm for insulation resistance and breakdown voltage respectively, which met the similar values at 0.5GΩ and 25Kv/mm of imported insulators. The investigated kaolin deposit from Sakpe met the standard for the production of porcelain insulators, refractories, ceramics materials and tiles, especially, between 35-45wt% kaolin and 25-35wt% Feldspar composition samples J, I and H which have the maximum values, in terms of the electrical, physical and mechanical properties at the temperature studied.

Keywords: Bida, ceramics, clay, kaolin, mullite, porcelain insulators.

1 INTRODUCTION

Clay is one of the basic raw minerals known to man and civilization. Its socioeconomic effect is as important today as it has been in the past. Nigeria (a developing industrial nation) has a potentially high demand for ceramics. It spends a large amount of financial resources on importing ceramic materials. There is an abundance of clay deposits in Nigeria, which has the potential to be utilized locally to meet these demands. Previous works on the various Nigerian clay deposits have been characterized and processed. Important details on phase and microstructural evolution during sintering was provided by Aladesuyi *et al.* (2017) in their analysis of Nigerian kaolin with compacts of calcined alumina powder. At high temperatures, an increased densification, better flexural strength and decrease in porosity at higher temperatures were observed in the material when used in the production of porcelain insulators.

The use of electricity has increased significantly in developing countries due to rapid industrial evolution and life style. Therefore, the use of insulators has become very much important in the prevention of the flow of current between the earth and wire by the use of poles or towers. The power industries have been on their toes tirelessly to develop extra voltage and long-distance transmission for easy and safe way to distribute electric power (Ezenwabude and Maduemc, 2015). The presence of insulators is vital in electrical systems, and are used extensively for high voltage applications.

Ceramic material known as porcelain insulator is created by heating raw ingredients, such as kaolin clay, to high temperatures in a kiln. The creation of glass and the mineral mullite inside the fired body at a high temperature gives porcelain its toughness, strength, and translucence. Due to its fast industrial fire cycles, wear resistance, extremely high density, and strong mechanical strength, it had been identified as a significant stoneware (Ezenwabude and Maduemc, 2015).

Electrical parts and equipment use insulation to sustain and separate conductors (not allowing the passage of current). Porcelain insulators are used in electrical systems to stop unwanted flow of current from its supporting points to the earth. It provides a channel with a very high resistance through which practically no electricity can pass. Because there needs to be an insulator between current-carrying conductors and poles in order to prevent the flow of current from conductor to earth, the overhead conductors for the transmission and distribution system are often supported by poles that are correctly grounded. (Ovri and Onuoha, 2015).

The majority of the literature on the compositions and manufacturing processes for porcelains uses foreign raw materials, which have different chemical, mineralogical, and physical properties than those that are readily available locally. As a result, additional efforts are being made to establish information and procedures about the creation of porcelain insulators using locally available raw materials.