American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-2, Issue-4, pp-12-15
www.ajer.us

Research Paper Open Access

The Effects of Groundnut Shell Addition on The Insulating Properties of Clay Samples From Kogi State Nigeria

Manukaji John U.
Federal Polyrechnic, Bida Niger State Nigeria

Abstract: Clay samples from three towns in Kogi state were examined with the aim of determining their chemical composition as well as testing for their suitability as refractory insulating materials for local furnaces. Refractories are required for many other industries in Nigeria like in chemical, ceramic, petrochemical, oil, foundry and iron and steel industries. The presence of air in these pores reduces the conductive capacity of the refractories and therefore increasing their insulating characteristics. Apart from the natural occurring fire clays which has been adjudged an insulating refractories, other clays can have their insulating characteristics improved by the addition of materials like saw dust, rice husks and other farm wastes. Experiments were carried out to determine how the addition of groundnut shell could improve the refractory properties of clay samples from Kogi State. The experiments were carried out on the four mechanical properties that enhance the insulating properties of clay which are linear shrinkage, thermal conductivity, apparent porosity and solid density .The results showed significant improvement in these properties.

Keywords: *Effects, groundnut shell on insulating properties, clay, Kogi State Nigeria*

I. INTRODUCTION

Nigeria as a developing economy houses a lot of industries that utilize refractory material in abundance. Nigeria also has abundant mineral resources including clay. Despite the large deposits of clay in many parts of the country, local manufacturing of refractory materials for local use had been very low. Refractories are used in metal melting and heat treatment industries because of their high temperature operating conditions. It is also used in industries both as lagging and insulating material. They degenerate with time and therefore need replacement Abifarin (1999). If the industries that use them are to remain in business, replacement must not only be produced but also must be locally sourced. clay minerals are of secondary geologic origin i.e. they were formed as alteration products of alumino-silicate rocks in an environment in which water is present Olusola (1998). Clay minerals are produced mainly from the weathering of feldspars and micas. They form part of a group of complex alumino-silicates of potassium, magnessium and iron, known as layer-lattice minerals. They are very small in size and very flaky in shape, and so have considerable surface area Thring (1962).

MATERIALS AND METHODS

The clay samples to be used for the manufacturing of the base plates were mined from ten different locations on a particular sight in order to have a good representation of the sight. Three sights were used for the state in order to further give a wider sample spread for the state. The sights are

KOGI STATE : Uhodo, Oguma, Odogi

The mined clay samples from the ten locations on a sight were mixed properly and a representative specimen for test from that sight was produced using the cone and quartering system as recommended by the American Society of Testing Materials (ASTM).

The resultant specimen for each sight were kept in a P.V.C. bags and labeled as follows.

LOCATION	SPECIMEN LABEL
Uhudo	G
Oguma	H
Odogi	I

The raw materials for the production of various refractory products include kaolinite ($Al_2O_3.2SiO_2.2H_2O$), chromite ($FeOCr_2O_3$), magnesite ($MgCO_3$) and various other types of clays. Agha (1998) Therefore in determining the suitability of the clay samples from Kogi state, as refractory material the chemical constituents of the specimens, were first determined using The Atomic Absorption Spectroscopy method. The results obtained are as shown in the table below

TABLE 2: CHEMICAL ANALYSIS

Oxides in Specimen	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O	Na_2O	L.O.I
G in %	44	35	1.3	2.4	0.5	0.6	1.5	0.7	14
H in %	45	34	1.5	1.5	0.4	0.1	1.4	0.1	16
I in %	46	34	0.9	3.0	0.2	0.4	1.2	0.3	14

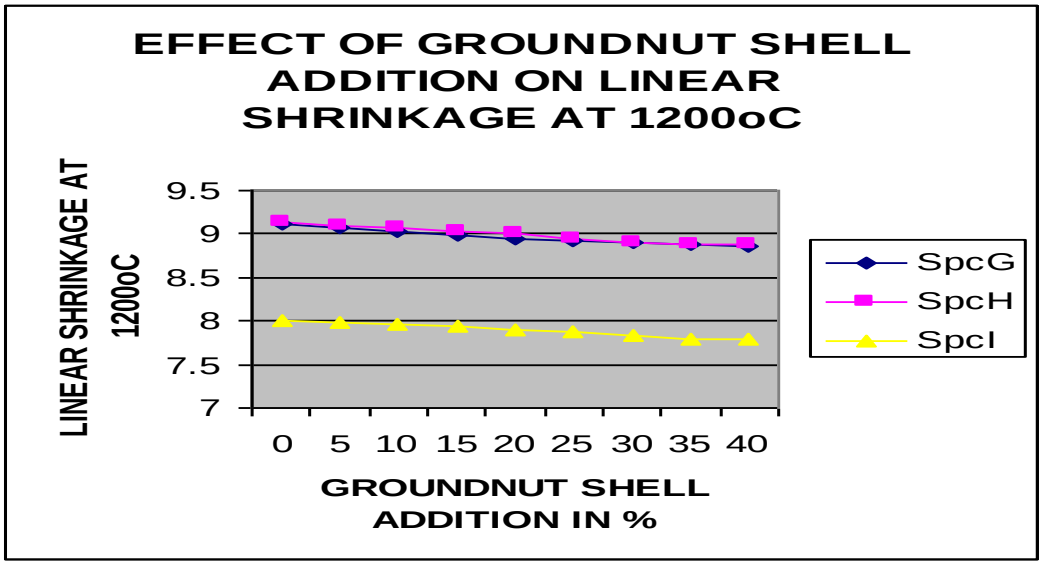
Manukaji(2004)
opined that for a refractory clay to have good insulating characteristics, it must have amongst others the following characteristics

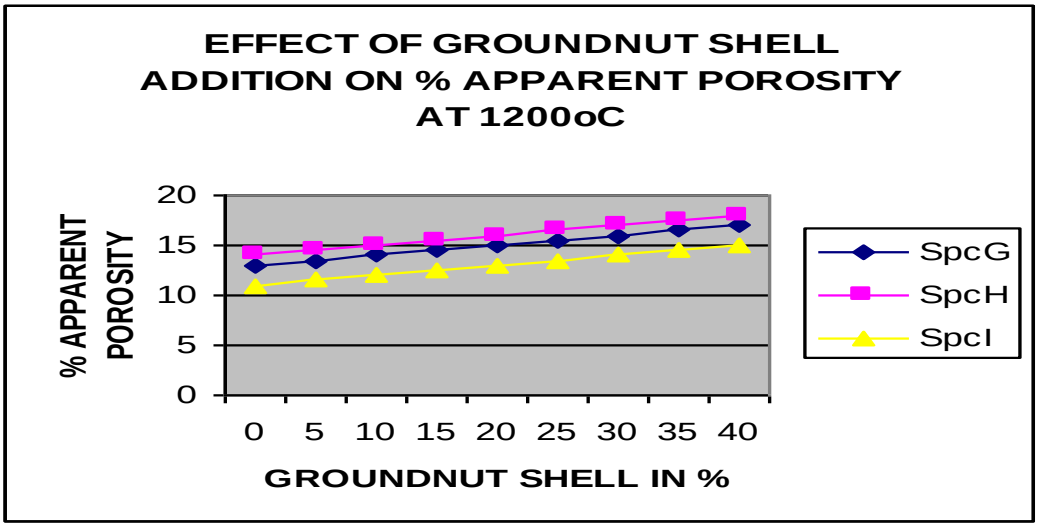
(1) It must be highly porous
(2) It must have low thermal conductivity
(3) It must have low solid density
(4) It must have a reasonably low linear shrinkage.

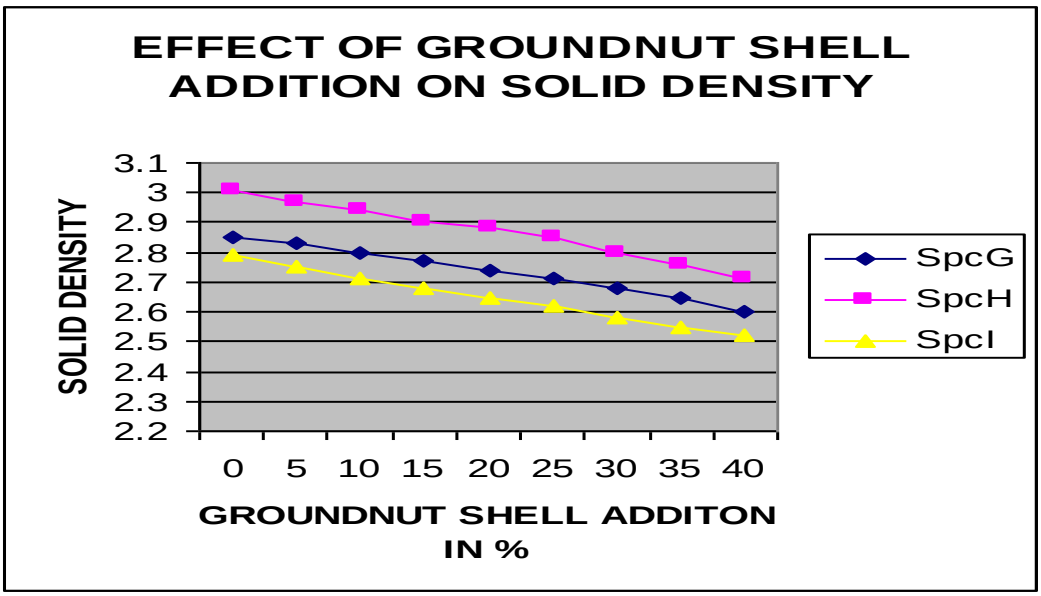
II. RESULTS AND DISCUSSION

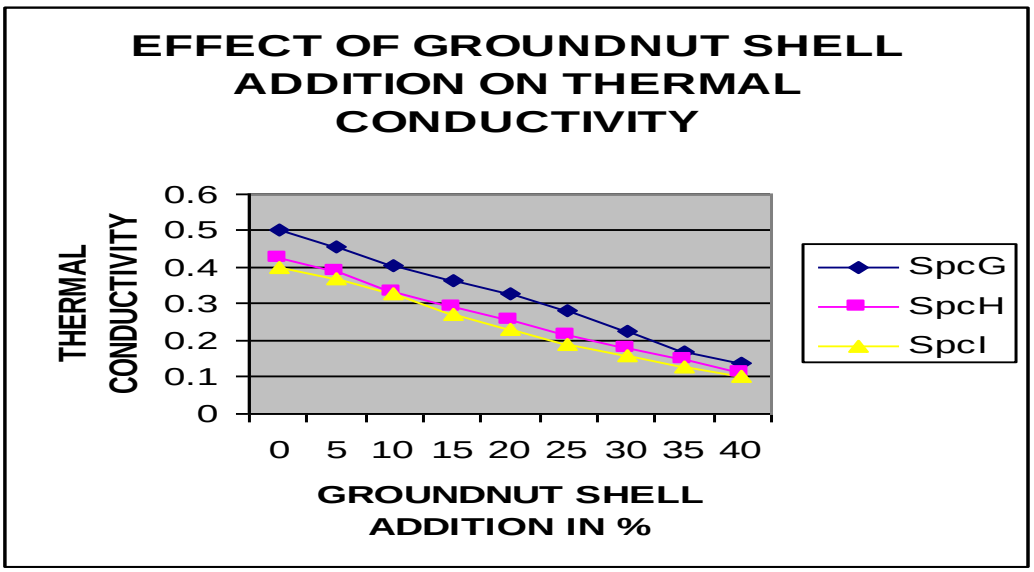
The effects of groundnut shell addition on the above properties of the clay specimens were studied and the results are shown and discussed as follows.

1. The linear shrinkage showed a steady reduction in value as the quantity of groundnut shell addition increased thereby bringing the values closer to the lower values of the acceptable range of 7-10% IEE(1992).
2. The apparent porosity increased in value from 12% to 18% in most of the samples thereby bringing them closer to the international range of 20-80% Theraja et al(1999), Oaikhinan (1988).
3. The solid density of the samples reduced steadily as the groundnut shell addition increased moving them closer to the lower acceptable range of 2.3-3.5g/cm^3 Ijagbemi (2002)
4. The thermal conductivity of the samples decreased steadily as more groundnut shell was added making the samples better insulators Manukaji(2004)




EFFECT OF GROUNDNUT SHELL ADDITION ON % APPARENT POROSITY AT 1200oC
% APPARENT POROSITY
20
15
10
5
0
0 5 10 15 20 25 30 35 40
GROUNDNUT SHELL IN %
SpcG
SpcH
SpcI


EFFECT OF GROUNDNUT SHELL ADDITION ON SOLID DENSITY
SOLID DENSITY
3.1
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
0 5 10 15 20 25 30 35 40
GROUNDNUT SHELL ADDITON IN %
SpcG
SpcH
SpcI


EFFECT OF GROUNDNUT SHELL ADDITION ON THERMAL CONDUCTIVITY
THERMAL CONDUCTIVITY
0.6
0.5
0.4
0.3
0.2
0.1
0
0 5 10 15 20 25 30 35 40
GROUNDNUT SHELL ADDITION IN %
SpcG
SpcH
SpcI

III. CONCLUSION AND RECOMMENDATION

From the tests carried out on the addition of groundnut shell to the clay samples, it could be concluded that properties like porosity, thermal conductivity, linear shrinkage and solid density of the clays from these locations improved significantly and can be varied to suit the particular insulating property desired.

RECOMMENDATIONS FOR FURTHER WORK

Based on the tests carried out on clay samples from Kogi State, further improvements on the insulating properties could be achieved by the addition of materials like rice husks, sawdust, bentonite, graghite asbestors, coal and other farm wastes. Further improvement could also be carried out by passing the clay samples through a magnetic sieve to reduce the content of Fe_2O_3 present in the clay.

REFERENCES

[1]. Agha O A (1998) Testing of local refractory clay for producing furnace lining bricks. M. Eng. Thesis: Mech. Eng. Dept. F.U.T. Minna

[2]. Abifarin M. S. (1999) Investigation on local refractory materials for high temperature applications, PhD Thesis mech. eng. dept. Federal University Of Technology, Minna

[3]. IEE (1992) Wiring regulation requirement for electrical installation BS7671 , 15th Edition , A Mclay and co. Ltd Cardiff

[4]. Ijagbemi C.O.(2002) Development and performance evaluation of a biomass clay lined cookstove. Meng thesis , Department of mechanical Federal University of Technology Akure, Nigeria.

[5]. Manukaji J.U.(2004) An investigation into the use of local clays as a high temperature insulator for electric cookers. PhD Thesis mech. eng. dept. Federal University Of Technology, Minna

[6]. Oaikhinan E.P (1988) Rheological properties of certain Nigerian clay. Proceedings of the international ceramic conference Australia.

[7]. Olusola E O (1998) Investigation of Zungeru clay as refractory material for high temperature applications M. Eng. Thesis, Dept. of mech. engrg. F. U. T. Minna

[8]. Theraja B. L. and Theraja A. K , (1999) Electrical technology, S. Chand and co. Ltd, New Delhi