

ABSTRACT

The brick Industry in Jamaica is extinct due to the high cost of fuel required to sinter the bricks. Therefore, low cost silicate bonded ceramics requiring no sintering, are developed. The raw material used is a mineral waste, which is a by-product of the alumina refineries in Jamaica. The bonding mechanism is achieved by vacuum impregnating liquid sodium silicate solution in compacted red mud.

The raw material is pulverised to specific particle sizes, and specimens are prepared by compaction. They are vacuum impregnated with sodium silicates of concentrations varying from 20% to 80% by volume. The amount of silicate absorbed by the specimens varied between 0.28 and 12.01 weight %.

Measurements of mechanical and physical properties are carried out. Fracture Toughness varies between 0.20 and 0.91 $\text{MNm}^{-3/2}$; Compressive Strength between 7.94 and 36.97 MNm^{-2} ; Modulus of Rupture between 5.66 and 16.52 MNm^{-2} ; and Brinell Hardness Number between 22.40 and 54.37 Kg mm^{-2} .

Scanning Electron Microscopy and Energy Dispersion X-Ray analysis are done to explain the observed properties. They reveal growth of needle shaped crystal structures of silicates of aluminium and iron. These crystals enhance the strength of the material by acting like whiskers, or silicates of layer coating the crack tips in the pores.

The durability of the silicate bonded material against water and acid attack is shown by weathering studies.

A comparison of the mechanical properties obtained with the silicate bonded ceramics and sintered red mud ceramics is also discussed. In addition a limited study is carried out with other locally available materials.