

Evaluation of the Dry Compressive Strength of Refractory Bricks Developed from Local Kaolin

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Abstract : Modeling the dry compressive strength of sodium silicate bonded kaolin refractory bricks was studied. The materials used for this research work included refractory clay obtained from Ijero-Ekiti kaolin deposit on coordinates 7° 49' N and 5° 5' E, sodium silicate obtained from the open market in Lagos on coordinates 6°27'11"N 3°23'45"E all in the South Western part of Nigeria. The mineralogical composition of the kaolin clay was determined using the Energy Dispersive X-Ray Fluorescence Spectrometer (ED-XRF). The clay samples were crushed and sieved using the laboratory pulveriser, ball mill and sieve shaker respectively to obtain 100 µm diameter particles. Manual pipe extruder of dimension 30 mm diameter by 43.30 mm height was used to prepare the samples with varying percentage volume of sodium silicate 5 %, 7.5 % 10 %, 12.5 %, 15 %, 17.5 %, 20% and 22.5 % while kaolin and water were kept at 50 % and 5 % respectively for the comprehensive test. The samples were left to dry in the open laboratory atmosphere for 24 hours to remove moisture. The samples were then fired in an electrically powered muffle furnace. Firing was done at the following temperatures; 700°C, 750°C, 800°C, 850°C, 900°C, 950°C, 1000°C and 1100°C. Compressive strength test was carried out on the dried samples using a Testometric Universal Testing Machine (TUTM) equipped with a computer and printer, optimum compression of 4.41 kN/mm² was obtained at 12.5 % sodium silicate; the experimental results were modeled with MATLAB and Origin packages using polynomial regression equations that predicted the estimated values for dry compressive strength and later validated with Pearson's rank correlation coefficient, thereby obtaining a very high positive correlation value of 0.97.

Keywords : dry compressive strength, kaolin, modeling, sodium silicate

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