World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:12, No:09, 2018

Characterization of the Physicochemical Properties of Raw and Calcined Kaolinitic Clays Using Analytical Techniques

Authors : Alireza Khaloo, Asghar Gholizadeh-Vayghan

Abstract : The present work focuses on the characterization of the physicochemical properties of kaolinitic clays in both raw and calcined (i.e., dehydroxylated) states. The properties investigated included the dehydroxylation temperature, chemical composition and crystalline phases, band types, kaolinite content, vitreous phase, and reactive and unreactive silica and alumina. The thermogravimetric analysis, X-ray diffractometry and infrared spectroscopy results suggest that full dehydroxylation takes place at 639°C, converting kaolinite to reactive metakaolinite ($Si_2Al_2O_7$). Application of higher temperatures up to 800 °C leads to complete decarbonation of the calcite phase, and the kaolinite converts to mullite at temperatures exceeding 957 °C. Calcination at 639°C was found to cause a 50% increase in the vitreous content of kaolin. Statistically meaningful increases in the reactivity of silica, alumina, calcite and sodium carbonate in kaolin were detected as a result of such thermal treatment. Such increases were found to be 11%, 47%, 240% and 10%, respectively. The ferrite phase, however, showed a 36% decline in reactivity. The proposed approach can be used as an analytical method to determine the viability of the source of kaolinite and proper physical and chemical modifications needed to enhance its suitability for geopolymer production.

Keywords : physicochemical properties, dehydroxylation, kaolinitic clays, kaolinite content, vitreous phase, reactivity
Conference Title : ICGC 2018 : International Conference on Geopolymer Concrete
Conference Location : Osaka, Japan
Conference Dates : September 13-14, 2018