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The influence of metakaulinite crystallinity on the properties of a geopolymer

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Abstract - Geopolymers is a result of polymers condensation of alkali aluminosilicates and silicates causing three-dimensional polymer structures. The chemical and physico-chemical properties of their precursors influence directly on the properties of the material hardened. To understand what happens in geopolymerics pastes, this work studies the crystallinity of metakaulinite on the rheological and mechanical properties of geopolymer. It was hereby concluded in this study that the high degree of metacaulim crystallinity directly influence the thickening time. This makes their components not react by preventing the hardening of the paste.

Geopolymers are materials mainly made of aluminosilicates, with the addition of potassium and/or sodium or even calcium. They are materials highly resistant to damage and thermal degradation, and over time have been used for multipurpose. The research of these materials began in the last century. Davidovits began research in this area looking for polymers with inorganic characteristics, not based on polymeric materials with carbon chains formation. The idea was to work with geological elements made of silicon using low temperature, thus it was observed that was not only possible to obtain a resin, but also an aggregation material and cement. Some Geopolymerics materials have been synthesized from sources of silica using fly ash, slag from furnace, minerals containing Al and Si and clays (kaolin and metakaulinite). Should be considered, however, that depending on the kind and nature of the starting material used, the chemical and physical properties of geopolymer formed will be directly affected [2]. Based on what was exposed, the objective of this work is to study the influence of metakaulinite crystallinity on the mechanical properties, the thickening time of the geopolymerics paste. Were used 3 types of metakaulinite, produced with different times of calcination, metakaulinite 1, metakaulinite 2, metakaulinite 3. The metakaulinite was characterized by X-ray Diffraction (XRD) and energy dispersive spectrometry (EDX). For formulation of geopolymerics pastes were used metakaulinite, potassium silicate and potassium hydroxide, with molar ratio Si/Al of 3.5. Was studied the mechanical properties and thickness according to NBR 9829 and NBR 9830 [3,4]. The hardened paste was characterized by Infra-red spectroscopy, X-ray Diffraction (XRD), energy dispersive spectrometry (EDX), thermogravimetric analysis and SEM. The results showed that as higher is the crystallinity of metakaulinite, higher is the thickening time, been the metakaulinite 1, which was produced with the lowest time of calcination, soon showed higher degree of crystallinity, no catching the thickening time after 15 hours of testing. Table 1 shows the values of the thickening time and mechanical resistance of the geopolymerics pastes. From the results concluded that as more amorphous is the metakaulinite, bigger is their reactivity and better properties will be found in a geopolymeric paste.

Table 1: Thickening time and Mechanical properties of Metakaulinite

	Thickening time	Mechanical properties
Metacaulim 1	---	---
Metacaulim 2	66 min	12 MPa
Metacaulim 3	44 min	18 MPa

References

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