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Production and characterization of magnesium cement using kaolinite clay

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Magnesium silicate cement is produced by mixing a reactive magnesium oxide with a source of reactive silicon. This cement is an interesting alternative to Portland cement due to potential of low energy consumption, reduced greenhouse gas emissions and use renewable resources. In addition, it can be used in some applications where conventional cement is not a suitable alternative due to the lower pH values. Normally, silica fume is used as a source of silicon in MgO-SiO₂ systems, however it is an expensive and poorly available material. Thus, this work aims to study the use of kaolinite clay to produce a magnesium aluminosilicate cement. The cement was produced by calcination of magnesium carbonate (MgCO₃) and kaolinite clay at a temperature of 800 °C for 45 minutes in MgCO₃/kaolinite ratios of 90/10, 80/20 and 70/30. In the development of the study, compressive strength test was carried out on mortars and microstructural tests on pastes (infrared spectroscopy with Fourier transform, X-ray diffraction and scanning electron microscopy with energy dispersive X-ray spectroscopy). The samples were cured at 60 °C with relative humidity greater than 95%. The results showed that the 70/30 sample yielded 32.7 MPa after 3 days of curing. Microstructural studies indicated the incorporation of aluminum for the formation of magnesium aluminosilicate hydrated products (M-A-S-H), in addition to the formation of brucite (Mg(OH)₂). Therefore, the work showed that the production of magnesium cement using kaolinite clay presents promising results for the development of a sustainable cement.