ABSTRACT

The present report is referred to a research work, concerning a PhD Thesis elaborated during a period of four years, between 1999-2003, about the conditions of alkaline activation of natural alumino-silicates. Kaolin, a product resulting from the alteration of feldspars that are one of the main constituents of granitic rocks, is rich in kaolinite, a clay mineral that is composed of multiple layers of tetrahedrical sheets of silica and octahedrical sheets of alumina (gibbsite), incorporating atoms of oxygen and hydroxyl groups of OH.

By thermal treatment at 750ºC, during a certain period of time, the kaolinite losses almost its water of constitution, transforming themselves in an amorphous and irreversible metaphase, with has a great potential of combination. This metaphase is currently named metakaolin.

Metakaolin, when is activated by alkaline reagents, as sodium hydroxide and sodium silicate, experiments in a very short time a reactive process, involving a dissolution/condensation phase which gives raise to materials that becoming hard at room temperature, are able to develop remarkable mechanical capacity and noticeable chemical behaviour after a time that can be as short as 1 hour, depending on curing conditions.

Those materials can be mixed with stone aggregates of all kinds to form mortars and concretes of the same type that is current with ordinary portland cement, being possible that a strong chemical bond is developed at the interface "paste-aggregate" that can improve the tensile capacity of the final products.

In this report, the results of the study and characterization of raw materials and alkaline reagents are displayed and it is made an approach of the conditions of formulation, mixture, compaction and cure of mortars and concrete using this new type of binder. At the same time it is made a global study on the mechanical behaviour of the final products, the influence that factors as age, reagents concentration, liquid-to-solids ratios and others, may have on the alkaline activation and also durability studies on the overall capacity of (geo)concretes to resist to chemical and abrasive aggressions. Geopolymers must be considered materials easy to make, which use current raw materials, most of them are inorganic wastes from several industries, as fly-ashes, blast furnace slag and others, and they do not demand special conditions to hard and to develop a high level of mechanical strength. Its general field of application is very large, from concretes and mortars for foundations and building construction, but also to geotechnical applications in piling or soft soils improvement and in different areas as ballistic or inorganic plastics.