CURRENT KNOWLEDGE OF GEOPOLYMERS AND AAMS NETWORK

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The action of alkali on aluminosilicates, such as clays, has been investigated since 1927. From clays and fired clays, the experiments expanded to other aluminosilicates, bauxites, laterites, volcanic ashes, nephelines as well as to industrial by-products or waste, such as fly ash, granulated blast furnace slags, mine tailings, red mud, bottom ash from urban waste incineration or biomass energy plants. The partial amorphisation of Al-containing raw materials with a high silica content by thermal treatment results in the formation of amorphous alkali-soluble aluminosilicates [Luukkonen, 2022, Pacheco-Torgal et al, 2015]. Dissolution of silica and alumina is affected by leaching the heat-treated raw material with sodium hydroxide solution. The dissolved species then enter in a complex reticulation process that might also include the formation of CaO-SiO_2-H_2O gel when CaO is present, concluding in a consolidated ceramic-like material with excellent performances in terms of chemical and mechanical stability. Very recently, a large number of papers have been dedicated to the study of the details surrounding the Al and Si atomic arrangement in space of the possible nano-structural variants of geopolymers as well as the correlations that link these nano-structures with the properties of the final consolidated material. In "Portland cement - alkali cement" hybrid systems both N - A - S - H- and C - S - H- gels evolve over time towards C - A - S – H type structures. However, depending on the total amount of Ca available in the binder (when there is no excess Ca), a fraction of the N - A - S - H gel may remain unchanged in the system, sharing space with the C - A - S - H gel (indefinitely, unless the N - A - S - H gel may eventually transform into a zeolite) and thus sharing the competence to provide the material with mechanical strength and durable properties. The proper formulation of the activating solution and curing procedure is critical for the performance of final product’s.

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