LOW-TEMPERATURE ALKALINE ACTIVATION OF FELDSPATHIC SOLID SOLUTIONS: DEVELOPMENT OF HIGH STRENGTH GEOPOLYMERS

E. Kamseu, Dipartimento di Ingegneria “Enzo Ferrari”, via Pietro Vivarelli 10, Italy ; Local Material Promotion Authority (MIPROMALO), Cameroon
A. Sola, Dipartimento di Ingegneria “Enzo Ferrari”, via Pietro Vivarelli 10, 41125 Modena, Italy
M. Messori, Dipartimento di Ingegneria “Enzo Ferrari”, via Pietro Vivarelli 10, 41125 Modena, Italy
A. Nana, Laboratory of Noxious Chemistry and Environmental Engineering (LACHINGE), Faculty of Science, University of Dschang, Cameroon.
H. K. Tchakoute, Laboratory of Applied Inorganic Chemistry, University of Yaoundé I, Faculty of Science, Cameroon.
C. Leonelli, Dipartimento di Ingegneria “Enzo Ferrari”, via Pietro Vivarelli 10, 41125 Modena, Italy

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Most of the natural solid solutions, as a result of the history of their formation and crystallization, present a fraction of amorphous or metastable materials that may easily be dissolved or activated in alkaline media. In this work, trachyte, granite, pegmatite and sand for comparison are used as principal solid precursors for the design of high strength geopolymers. The particularity of the solid-solution based geopolymers is the high fraction of crystalline phases incongruently dissolved that may react essentially at the surface, thus developing very resistant bonds. While working with 100 wt% of solid solution is almost unrealistic for the production of geopolymers, it was found that 15 to 30 wt% of metakaolin in replacement of the solid-solution powder conducts to low porosity (10 vol.%), high flexural strength (20-30 MPa) and compact microstructure. Preliminary resonance-based mechanical tests showed that the elastic modulus of the investigated samples ranged between 11-15 GPa, as also confirmed by instrumented micro-indentations. It was concluded that a high strength and durable matrix are a result of chemico-mechanical equilibrium of phases contained within the composites including the pore volume and pore-size distribution, which are significant for the life cycle of geopolymer composites.