Abstract

This article reports on research into the use of solid alkalis (Na_2CO_3 and K_2CO_3) as activators to obtain hybrid cement (cement whose hydration generates a mix of C-A-S-H and (N,C)-A-S-H gels) from a blend of 20% clínker + 40% blast furnace slag + 40% metakaolin. More specifically, the study aimed to determine the effect of activator dosage (5 and 8 wt%) and type of alkaline cation (Na^+ or K^+) on the 2- and 28-d mechanical strength of the end materials. The findings showed that the highest mechanical strength values were obtained with 5% Na_2CO_3. According to the XRD, NMR, and SEM/EDX analyses conducted on the reaction products, the alkalinity and solubilized chemical species generated by adding 5% Na_2CO_3 to the system yielded a mix of (N,C)-A-S-H and C-A-S-H cementitious gels as the main reaction products. The secondary reaction products included metastable ($3CaO{\cdot}Al_2O_3{\cdot}CaCO_3{\cdot}11H_2O$-type) carboaluminates that evolved into the calcite or vaterite forms of calcium carbonate. When $K_2CO_3$was used (instead of Na_2CO_3), a ($3CaO{\cdot}Al_2O_3{\cdot}0.5Ca(OH)_2{\cdot}0.5CaCO_3{\cdot}\ 11H_2O$-type) hemicarboaluminate also formed. The study also revealed that Na^+ favors coagulation/precipitation more effectively than K^+, generating gels with a wider range of Q^n species. © 2013 The American Ceramic Society