HIGH TEMPERATURE CONCRETE / MONOLITHICS FOR APPLICATION IN KILN AND FURNACES: ROLE OF CHEMISTRY

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ABSTRACT

The conventional high temperature concrete for application in kiln and furnaces is a mixture of refractory aggregate and calcium aluminate cement binder. The $CaO\text{-}Al_2O_3$ binary equilibrium diagram provides useful information regarding existence of various calcium aluminates, out of which $CA(CaO.Al_2O_3)$, $CA_2(CaO.2Al_2O_3)$ and $C_{12}A_7(12CaO.7Al_2O_3)$ are considered to be the most important hydraulic phases having wide applications as binder to produce high temperature concretes. In the present study, high temperature concretes were prepared utilizing different types of refractory aggregates and synthetically prepared CA, CA_2, $C_{12}A_7$ binders in single or in combination and allowed the samples to undergo hydration at different temperatures and different periods of time. It has been observed that water converts anhydrous calcium aluminates into different hydrated phases and the hydration reaction scheme has been different for each of the calcium aluminates. The major hydraulic phases were identified as CAH_{10}, C_2AH_8, C_3AH_6 ($C=CaO$, $H=H_2O$) which contribute towards strength development. A distinct change in crystal morphology was seen in each individual calcium aluminates and also when they were mixed in certain proportions. The chemistry of refractory aggregate has a considerable influence upon the quality of castable product for high temperature applications in kiln and furnaces. The paper discusses some of these issues. The process of making high temperature concrete utilizing commercially available tabular alumina aggregate, reactive alumina fines and calcium aluminate cement binder will also be demonstrated along with their main testing methods.