

ZIRCONIA PHOSPHATE CERAMIC SETTING BINDER FOR REFRACTORY CONCRETES BONDING

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The strength development during the initial curing periods and installation of refractory-concrete linings are critically dependent on the use of binder as the main ingredient of effective composite materials.

Conventional refractory cements (calcium aluminate, high Al_2O_3 , aluminate phosphate and other) continue to be the most popular hydraulically setting binders used for bonding refractory concretes. However, refractory concretes bonded with traditional binders have limited refractory applications because of the strength degradation resulting from structural defects caused by occurrence of dehydration process, bonds disruption, easy-melting compositions forming. Unlike calcium aluminate (CA) cements, zirconia phosphate ceramic setting binder (specially formulated, suspension-aggregate mix) retains its integrity when subjected to prolonged periods of high heat, cyclic heating and cooling, and other deleterious conditions of corrosion and erosion presented in high temperature industrial processes. It has a sequential effect on the service life and performance of a refractory-concrete lining bonded with zirconia phosphate ceramic setting binder; that is, 1) quick installation of refractory lining and low construction costs, 2) developing of initial strength requires fewer times, 3) thermal efficiency permitting thinner lining.

Rapid relining of processing units is a major demand of refractory industry. Developing of initial strength during a heatup of the refractory lining within 8-10 h for zirconia phosphate ceramic setting binder, in contrast to 24 h after placement for high Al_2O_3 cements and 28 days for normal Portland-cement, could become commonplace prior to final heatup of the units being installed with using of ceramic setting binder technology.

The use of refractory concrete bonded with zirconia phosphate ceramic setting binder provides the significantly quick installation of lining because the initial strength developing requires no setting time in contrast to the concrete bonded with hydraulically setting cement. The desired structural integrity and strength development are mostly achieved during the dryout and heatup of the unit. These processing steps are not accompanying with additional shrinkage and the loss in strength in the 300 to 900 °C range compared with high Al_2O_3 concrete.

The zirconia phosphate refractory concretes obtained retain their volume integrity when subjected to prolonged periods of cyclic heating and cooling (after 30 shock cycles) present in high temperature industrial processes. The zirconia phosphate refractory concretes can be used for refractory applications 1800 °C. They require only a drying at 300 °C and 2 h to develop sufficient strength of lining while a heatup within 8 h contributes to the hot strength 60 MPa.