STANDARD AGGREGATE FOR CALCIUM ALUMINATE PHOSPHATE (CAP) CONCRETES EVALUATION

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The dense refractory concretes compositions developing is critically dependent on requirement of the minimum porosity and shrinkage to assure volume stability. It is important also that the voids between the grains of aggregate and binder to be filled to achieve the proper placeability and workability of concrete mix.

Among various refractory aggregates that might be considered for evaluating the bonding characteristics of all CAP binders types only fused and sintered aluminas (corundum) have adequate refractoriness and are sufficiently chemically inert. Properties of aggregates that markedly affect setting properties are soluble salts, colloidal fines, particle-size distribution, amount of porosity and pore size. Except for the larger amount of open porosity in the coarser fused alumina grain, both aggregates can be sufficiently controlled to have no effect on setting time.

Evaluation of CAP binders in concrete compositions requires that the variation in particle size of aggregate be minimized. This can be achieved by using closed aggregate sizes to approximate the ideal continuous size distribution designed for maximum packing. The ideal distribution will be matched at one less than the number of size fractions used. It follows then that the ideal distribution will be more closely matched as the number of sized components increases.

Maximum packing is accomplished for the two-fraction aggregates mixes when they contain 60 – 70 % coarse and 30 – 40 % small fraction. Wherein, the dense packing can be accomplished when the average size of small aggregate in 6 – 7 time less than the coarse. Considering this, the dense packing for aggregate mix with maximum grain size 3 mm is obtained when it contains 60 % of 3 – 0,5 mm fraction and 40 % of less than 0,5 mm fraction. For aggregate mix with maximum grain size 2 mm the dense packing is obtained when it contains 50 % of 3 – 0,5 mm fraction and 50 % of less than 0,5 mm fraction.

It is imperative, therefore, that the "aggregate-binder" optimal ratio for CAP concrete compositions corresponds with the following requirements as 1) refractory concrete mix must have good placeability, 2) its dried castings must have homogeneous structure, and 3) to have sufficient strength and minimum shrinkage in service temperature range.

The better thermal-shock-damage resistance of corundum concrete bonded with CAP mechano-chemical binder is ascribed to the <5–10-μm closed pores which are thought to perform as crack arrestors and better mechanical bonding to the rougher concrete fractured surfaces. Besides increasing the strength value of the concrete bonded with CAP suspension would explain the more efficient use of the mechano-chemical bonding compared with hydraulically setting cement wherein some of the CAPC is lost in the large open pores of coarse grains.