CAI – ALON

Alumina for Calcium Aluminates

Calcium aluminates are significant mineral constituents of

- Portland cement and calcium sulfoaluminate cement (both used in the building industry)
- calcium aluminate cements (for construction and refractory applications)
- calcium aluminate fluxing agents (used in the steel industry).

Portland cement typically contains 4-6% Al2O3, in the form of the clinker phases 3CaO.Al2O3 and 4CaO.Al2O3.Fe2O3. Calcium sulfoaluminate cement, with about 25-40% Al2O3, is based on 3CaO.Al2O3.CaSO4. Calcium aluminate cements are produced with contents of 40-80% Al2O3, containing as main active the clinker phase CaO.Al2O3. Fluxing agents for steel contain about 50-55% Al2O3 and are based on 12CaO.7Al2O3. The traditional alumina source in the production of calcium aluminates is natural bauxite.

A cost-effective substitute for bauxite is CAI-ALON, providing about 83% Al2O3, on a calcined basis. The mineral components are corundum (alpha-Al2O3), spinel (MgO.Al2O3), aluminium nitride (AlN), metallic aluminium (Al), quartz (SiO2) and small quantities of fluoride and chloride (CaF2, NaCl). CAI-ALON is a dry powder with a particle size of 95% less than 0.3 mm.

CAI-ALON is produced by processing slag (dross) from melting aluminium metal. The advantages of using processed aluminium slag materials in the production of calcium aluminates are:

- faster sintering and smelting (due to the fine particle size)
- less energy for sintering and smelting (Al and AlN are exothermically converted to Al2O3),
- reduced temperature of sintering and smelting (due to the contents of CaF2 and NaCl),
- early setting of the cement (fluoride is incorporated in the clinker as 11CaO.7Al2O3.CaF2).

Literature

E.M.M. Ewais, Y.M.Z. Ahmed, N-M. Khalil, M.S. Amin, M.A. Barakat: Utilization of aluminium sludge and aluminium slag (dross) for the manufacture of calcium aluminate cement. International Colloquium on Refractories 2009, Aachen (Germany), 80-85
