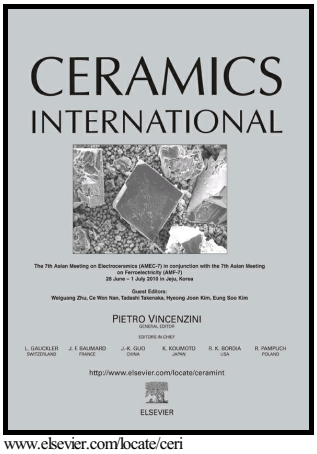

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Abstract

While incinerators are important for eliminating hazardous waste from industry, there are few publications on the corrosion of secondary combustion chambers. The sudden refractory failure results in high costs and work stoppages. Thus, corrosion in fireclay and bauxite-clay refractories exposed for 50 months to the harsh atmosphere in the chamber (H_2O, O_2, CO_2, SO_2, HCl, alkali vapors, etc.) was investigated. The operating temperatures of 930–1000°C heat the inner refractory face up to 950°C and the exterior face to 750°C. X-ray diffraction revealed that condensed alkali and sulfur compounds interacted with refractories. Thermodynamic calculations determined the critical chemical reactions. Our findings show a successive corrosion mechanism that starts with the condensation of thenardite (Na_2SO_4) and finishes with expansive phases. In fireclay bricks, the reaction with free silica led to liquid phases and slow creep. Sudden lining breakdowns were provoked by nepheline and nosean. Contrary to expectations, nepheline was not formed in the bauxite-clay bricks. Instead, only nosean was formed. In the literature, under laboratory conditions, no nosean has been observed in hot corrosion experiments. Perhaps, nosean requires several months to years to form inside the secondary combustion chamber. Our work indicates that to impede these corrosion processes, refractories should contain as little silica as possible.

Keywords: Failure analysis; Silicate; Refractories; Hot corrosion