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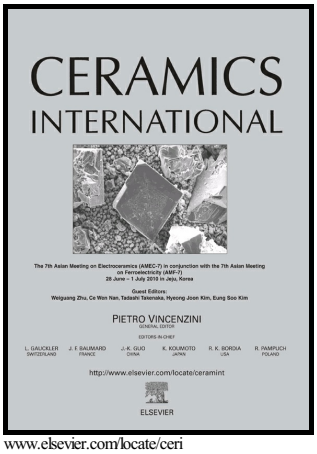

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PII: S0272-8842(17)30960-4
DOI: http://dx.doi.org/10.1016/j.ceramint.2017.05.148
Reference: CERI15308

To appear in: *Ceramics International*

Received date: 7 February 2017
Revised date: 21 May 2017
Accepted date: 21 May 2017

Cite this article as: Ren Bo, Li Yawei, Sang Shaobai and Jin Shengli Lightweight design of bauxite-SiC composite refractories as the lining of rotary cement kiln using alternative fuels, *Ceramics International* http://dx.doi.org/10.1016/j.ceramint.2017.05.148

Lightweight design of bauxite-SiC composite refractories as the lining of rotary cement kiln using alternative fuels

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Abstract: To meet the demand of energy-saving and adapt to the change from coal to the alternative fuel in the rotary cement kiln, bauxite-SiC refractories were fabricated by the incorporation of silica sol coated lightweight mullite aggregates in order to achieve low thermal conductivity and superior alkali vapor attack resistance simultaneously. Furthermore, the mechanism of resistance to alkali vapor attach was investigated by means of X-ray diffraction (XRD) and scanning electron microscopy (SEM). Results showed that the thermal conductivity of bauxite-SiC specimens decreased gradually with increasing amounts of silica sol coated lightweight mullite aggregates while changes in the alkali vapor attach were not detectable. The shell-covered structure with a silica sol coating on the surface of lightweight aggregates hindered alkali vapor diffusion into the aggregates at high temperature. Bauxite-SiC refractories possessed lower thermal conductivity, superior alkali attack resistance and higher mechanical properties compared with the specimens which contained pristine lightweight aggregates.

Keywords: Bauxite-SiC composite refractories; Silica sol coating; Lightweight mullite aggregate; Thermal conductivity; Alkali vapor attack resistance

1 Introduction

Nowadays tremendous attention on heat loss reduction of industrial kilns and furnaces is paid towards decreasing the consumption of fossil fuel in the energy intensive industries [1-4]. In the last decade, several research works [5-8] have brought up a concept of lightweight lining of furnaces which possess appropriate mechanical properties, corrosion resistance and excellent thermal insulation performance compared with the traditional dense linings. In this case, lightweight microporous aggregates were partly incorporated into the linings, substituting for the dense aggregates. Guangping Liu et al. [6-8] prepared the lightweight alumina-magnesia castables as the lining of steel ladle using lightweight CA_6 aggregates and microporous corundum aggregates respectively. Enhanced heat insulation performance, good thermal shock resistance and molten slag resistance were obtained [9-11].

In the rotary kiln, the lightweight magnesia-spinel bricks were also newly developed to reduce the heat loss on the surface of the transition zone [12-13]. Decades ago, the hazardous

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