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Urea based sols as binder for Nano-oxide bonded high alumina refractory castables

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Abstract:

Cement free high pure alumina castables are developed for high temperature applications with nano oxide bonding developed by using different sol systems synthesized by using urea as the precipitating and hydrolyzing agent. Bonding of the constables is based on nano oxide powders of alumina, mullite and spinel compositions using their respective sols as bonding agents. The sols are prepared from nitrate precursors using urea and are used in the high alumina castable formulation. The castable compositions are conventionally processed using the synthesized sols as sole binders and characterized for various refractory properties after heat treatment at different temperatures. These synthesized sol containing compositions are also compared with the commercial silica sol containing ones and cement bonded castables, processed under similar conditions. Considerable improvement in terms of hot strength, corrosion resistance and thermal shock resistance are obtained for the synthesized sol containing nano oxide bonded castables.

Keywords:

Cement-free castable, Sol-gel binder, Urea, Hot-strength, Thermal-shock, Slag resistance.

1. Introduction:

Refractory castables are a form of unshaped refractories, the demand of which has seen an exponential rise in the last few decades. It consists of a non-continuous refractory phase (aggregates) inside a continuous bonding/matrix phase which is formed upon firing at higher temperatures. The interaction between the two phases at higher temperatures defines the properties of the final castable product. The continuous bonding phase (binder) is thus, a key factor during the processing of castables [1]. The conventional high alumina cement is widely used as binder for castables but, has limitations for very high temperature applications. The presence of CaO in cement results in various low melting phases with silica and alumina castable systems at higher temperatures and thus has a degradable effect on the refractory properties. In