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Colloidal processing of refractory cerâmica - a critical review

Prado, A.F.(1);
(1) EESC/USP;

The study of the rheology of ceramic suspensions aims to understand the flow and deformation properties of liquid mixtures containing suspended solid ceramic particles. The use of ceramic suspensions with adequate rheological properties are fundamental for processing and consolidation of the desired properties to the final product. As their properties are much more complex compared to other systems, the rheological characterization techniques may not be sufficient to respond to the dispersion behavior of these materials. Many publications approach rheology as a method to control viscosity in a homogenization process, without delving into the mechanisms of interaction between components present in the system. The objective of this work was to review the use of analytical methodologies for ceramic suspensions capable of answering questions for systems considered highly complex. Ceramic suspensions of alumina and colloidal silica were studied, this being a binder agent pointed as an alternative to the calcium aluminate cements used in refractory concretes due to its gelification capacity. In addition, recent studies show that the use of colloidal silica in monolithic refractory concrete facilitates the drying of these materials, a stage considered to be the most delicate of the whole process and which determines the future quality of the material, which consolidates after high temperature heat treatment. The work developed confirms the theory, although the presence of micro cracks in the surface of the parts have arisen and are possibly responsible for reducing their mechanical performance. In an attempt to identify the mechanisms of gelification involving the contact of Al2O3 particles with colloidal silica, used as an aqueous source and responsible for connecting all elements present in concrete, It is necessary to study the rheological behavior of the developed suspensions, since it involves the complexity of the colloid and the granulometric distribution of alumina used as a refractoriness source, forming a complex and highly viscous suspension. This review article aims to synthesize the methods used for the characterization of suspensions and identifies that bench equipment, such as viscometer and DLS (Dynamic Light Scattering) are not fully able to measure the dynamics presented during the mixing of these components, so that more advanced techniques such as XPCS (X-ray Photon Correlation Spectroscopy) are considered, which makes it possible to perform these measurements, because its high coherence characteristics associated with the high beam brightness available in a 4th generation particle accelerator are compatible with the need for response to concentrated suspensions.