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The Effect of Andreasen´s Packing Distribution Modulus on the Physical and Mechanical Properties of a Low Cement Refractory Castable

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Among modern refractory concretes (MRC), those with low cement content (LCC) where CAC = 4-6wt%, are widely commercialized, considering that their properties approximate those of burned bricks of the same class. In this work, the effect of the modulus q of Andreasen´s particle size distribution, on the physical (porosity, bulk density) and mechanical (flexural strength and dynamic elastic modulus) properties, of either pre-fired or simply dried specimens of a ?85% Al_2O_3 LCC´s, was investigated. The different LCC´s samples were formulated according to the Andreasen´s model, using several distribution modulus (q = 0.22, 0.26, 0.30, 0.33 and 0.42). Measurements of the Dynamic Elastic Modulus (DEM) as a function of temperature (25 to 1500°C), using the Impulse Excitation Technique (IET), were taken as a key indicator of the microstructure dynamic behavior. For the sake of just a punctual comparative terms, the physical and mechanical properties of a conventional type refractory concrete (CRC) with a higher CAC percentage (15%) formulated with q = 0.26 was also evaluated . The results indicated that distribution modulus values of; q =0.22, 0,26, 0.30 and 0.33 lead to higher DEM values. While q=0.42 lead to the smallest value in the LCC series. Also higher DEM values were obtained for LCC´s (CAC = 5%) than for conventional concrete with CAC = 15% under the same value of q for pre-fired samples. In addition, by observing the occurrence of damping effects in specific temperature ranges, the loss of crystallization water from the calcium aluminate hydrates, as well as the development of pyroplastic behavior could be inferred. The gathered information is relevant to predict the behavior of LCC´s and CRC´s when put into service for the first time.