

Phosphate Sludge Ceramics: Effects of Firing Cycle Parameters on Technological Properties and Ceramic Suitability

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Abstract : More than 26,4 million tons of phosphates are produced by the phosphates industries in Morocco (2010), generating huge amounts of sludge by flocculation during the ore beneficiation. They way are stored at the end of the process in open air ponds. Its accumulation and storage may have an impact on several scales such as ground water and human being. For this purpose, an efficient way to use it the field of the ceramic is proposed. The as received sludge and a clay-rich sediment have been studied in terms of chemical, mineralogical and micro-structural side using various analytical methods. Several formulations have been performed by mixing the sludge with the binder shaped in the form of granules. After being dried at 105 °C, the samples were heated in the range of 900-1200 °C. As well as the ceramic properties (firing shrinkage, water absorption, total porosity and compressive strength) the micro structure has been investigated using X-ray diffraction, scanning electron microscopy and Fourier transform infrared spectroscopy. The relations between properties and the operating factors were formulated using the design of experiments (DOE). Gehlenite was the only phase neo-formed in the sintering samples. SEM micrographs revealed the presence of nano metric stains. Based on RSM results, all factors had positive effects on Firing shrinkage, compressive strength and total porosity. However, they manifested opposite effects on density and water absorption.

Keywords : phosphate sludge, clay, ceramic properties, granule

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