Clinker Phase Composition Determination by Backscattered Electron Image Analysis and Rietveld Refinement

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During the last 10 years, the production and consumption of cement and concrete have been a central aspect of the economy and building industry, especially for the developing countries. The phase composition of cement and clinker exerts critical controls not only on hydration reactions and resulting cementitious properties, but also on sulfate resistance and durablility in concrete. From this point, it is very important to determine the phase composition of clinker materials.

This paper presents a new segmentation method, based primarily on image texture filters and edge detector algorithms, to analyze backscattered electron data to compute phase composition (Fig 1). The ratio between alite (impure Ca_3SiO_5) and belite (impure Ca_2SiO_4) of clinker can also be determined by this method, albeit with limited grey scale contrast. Analysis of these results allow important comparisons between grey scale method and X-ray diffraction refinement results. These methods have been implemented for both Portland cement and Alite-Ye'elimite cement clinker in this work, and also hold some potential for determining the composition of hydration products.
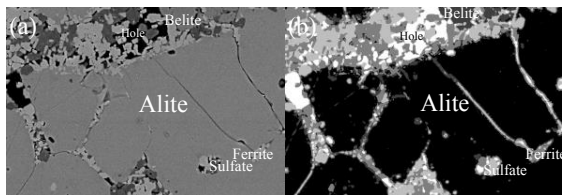

Fig. 1 Clinker SEM data (a) Original backscattered electron image; (b) Segmented backscattered electron image.