Chemistry and engineering of the clinkerization process — Incremental advances and lack of breakthroughs

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ABSTRACT

"Chemistry" and "process engineering" constitute the foundation of the clinkerization process but over the decades the engineering advances have been phenomenal to convert the chemical concepts into very large, fast reacting, energy-efficient and pollution-abated pyroprocessing systems. Excepting the cooler design that still lags behind in attaining the desired cooling rate for clinker phases, notwithstanding several innovations for thermal efficiency, the rest of the engineering for the pyroprocessing system seems to be touching a plateau of efficiency parameters. However, the occurrence of volatile cycles and controls of process and quality are governed more by the systemic parameters than simple chemical behavior of the feed materials. The emission norms and the engineering control features are mostly in sync with each other, except the organic emissions of dioxins, furans, PCBs and PAHs, where more precise determination of their precursors is called for.

In respect of breakthroughs in new pyroprocessing technologies other than the conventional rotary kilns, the initiation of research dates back to eighties but the researches remain stalled perhaps in apprehension of non-viability. They need to be revived for efficiency and sustainability. The nano-cement technology should also be evaluated more intensely for its application potential.

The present keynote paper attempts to portray the present status of pyroprocessing and to define the areas of challenges lying ahead.

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