Carbonation of Ca Based Waste Materials from FBC Boilers

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ABSTRACT

The use of high sulphur fuels in Fluidized Bed Combustion (FBC) results in high CaO contents for the resulting ashes. As a result the ashes react exothermically with water, produce high pH leachate, and are also subject to significant and uncontrolled expansion in the landfill, both of which factors add significantly to the disposal cost of the resulting FBC ashes. The current disposal practices involve a two-step hydration process, which is not particularly effective, and does not resolve either the problem of high pH leachate or expansion. Carbonation (i.e. reaction with CO_2 from the flue gases) offers a method of resolving all of these difficulties and depending on the sulphur content of the coal, also offers a method of reducing boiler CO_2 emissions by several percent. However, direct carbonation by using high pressures or temperatures is not sufficiently fast to make a viable conversion process. Work at CETC however, has shown that sonic energy both in its low frequency and high frequency version is capable of accelerating the carbonation process, and allowing the full range of ashes from a FBC to be quantitatively converted to $CaCO_3$. This approach, which has been patented by CETC, has been demonstrated at both bench-scale using ultrasound and industrial-scale using low frequency sound (100-500 Hz) which have been shown to be equivalent in their performance. This paper discusses the experimental work done by CETC and examines the feasibility of this approach for the treatment of high calcic ashes from industrial-scale FBC boilers.