Carbonation of Brine Slurried Size Fractionated Coal Combustion Fly Ash

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ABSTRACT

Coal combustion by-products such as fly ash (FA), brine and CO\textsubscript{2} from coal fired power plants have the potential to impact negatively on the environment. Reaction of CO\textsubscript{2} with FA/brine slurry can potentially provide a viable route for CO\textsubscript{2} sequestration through formation of mineral carbonates. Fractionated FA has varying amounts of CaO which not only increases the brine pH but can also be converted into calcite. Statistically designed controlled carbonation reactions were carried out in a reactor set-up to evaluate the effect of particle size, pressure, temperature and S/L ratio on the carbonation efficiency of FA. Input parameters: temperature and pressure were at two levels (30 °C and 90 °C; 1 Mpa and 4 Mpa), S/L ratio was at three levels (0.1, 0.5 and 1) while particle size was at four levels (bulk ash, <20 µm, 20 µm -150 µm and >150 µm). Carbonation using brine resulted in higher degree of calcite formation compared to ultra-pure water. The 20 -150 µm size fraction was observed to have the highest CO\textsubscript{2} sequestration potential while the >150 µm fraction had the lowest. Pressure was observed to have a slight influence on the % CaCO\textsubscript{3} yield while higher temperatures led to higher % CaCO\textsubscript{3} yield. The effect of S/L ratio was temperature dependent. The two most important parameters in the carbonation of FA/brine slurries were particle size and temperature.

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