

STEAM HYDRATION-INDUCED REACTIVATION OF CALCIUM LOOPING SPENT LIMESTONE-BASED SORBENTS

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This paper reports on the preliminary findings obtained by applying the steam-hydration technique to a spent German sorbent coming from a fluidized bed (FB) calcium looping process. The attention was focused on the regeneration of the sorbent CO₂ capture capacity induced by steam hydration, and on the effect that this technique has on the attrition tendency of the reactivated material. To this end, calcium looping (before and after steam hydration) and steam-hydration tests were carried out in a lab-scale FB reactor. In particular, steam hydration of the spent sorbent was carried out at 250°C for 10 min in a 50% steam-containing atmosphere. With reference to calcium looping tests, the rate of fines generation, the sorbent particle size distribution and the CO₂ capture capacity were monitored. Results highlighted the effectiveness of the steam-hydration treatment in reactivating the sorbent activity to CO₂ capture of the spent sorbent, and that steam hydration brought about only a very slight increase in the sorbent attrition tendency. Results were also compared with those obtained (and previously published) under the same operating conditions and with the same sorbent, reactivated by liquid water hydration at 25°C for 10 min. The spent sorbent generated in this study, when submitted to 10 min-FB steam hydration/reactivation, showed a value of the hydration degree equal to 15%, so indicating that under the present operating conditions the onset of the chemical hydration process was observable. Though the extent of the hydration reaction was limited, the steam-hydration treatment was effective in reactivating the sorbent activity to CO₂ capture: the CO₂ capture capacity raised from 0.04–0.06 g/g (last carbonation before reactivation) to 0.26 g/g (first carbonation after reactivation). Elutriation results highlighted that steam hydration brought about only a very slight increase in the sorbent attrition tendency: after 3 complete calcination/carbonation cycles, the cumulative loss of elutriated fines was 1.38% for the steam-hydrated sample, while this loss was 1.59% for the raw sorbent after 4 complete cycles.

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