Calcium looping, a post-combustion "carbon capture and storage" process (see Figure 1), is usually carried out by means of a limestone-based sorbent in a dual interconnected fluidized bed reactor. The two stages of this process are limestone calcination and carbonation: in the former case, water vapor can be present as a product of the auxiliary fuel combustion needed to drive this endothermal step; in the latter case, water vapor is usually present in the combustion flue gas stream bearing the CO2 to be captured. This work pursues previous research concerning the hydration-induced reactivation of spent sorbents (1, 2, 3) further and aims at investigating the effect of the presence of water vapor on the performance of a limestone-based sorbent, with particular reference to the attrition/fragmentation tendency. To this end, experimental tests were carried out in a lab-scale apparatus, under typical operating conditions in terms of temperature and gas composition. The role of water vapor in changing the sorbent CO2 capture capacity (with respect to a base-case operation in which water vapor was absent) and the attrition/fragmentation tendency was examined (see, for example, Figure 2 up and down, respectively). Results from CO2 capture will be complemented with characterization of sorbent particles, by means of scanning electron microscopy, porosimetric and X-ray diffraction analyses.

REFERENCES
Figure 1: Scheme of the calcium looping process.

Figure 2: (up) CO2 capture capacity displayed by sorbent samples as a function of the carbonation stages ("dry"=without steam; "ste_cal"=steam present upon calcination; "ste_car"=steam present upon carbonation; "ste_cal_car"=steam present upon both calcination and carbonation); (down) cumulative particle size distribution for sorbent samples cycled in calcium looping steps ("ste_cal_car" conditions).