MS18-P12 | In-situ carbonation of SrO at 298 K and controlled humidity for Thermochemical Energy Storage

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In this work the carbonation behavior of SrO under humid conditions was studied through *in-situ* pXRD measurements at room temperature conditions (298K) with respect to investigate the potential for thermochemical energy storage (TCES).

The experiments were performed on a PANalytical X'Pert Pro diffractometer in Bragg-Brentano geometry using Cu$K\alpha_{1,2}$. An Anton Paar XRK 900 reaction chamber was used monitoring *in-situ* the reaction. In order to investigate the carbonation in the presence of H_2O saturated conditions the CO_2 was previously passed through an external moisturizer.

The study reveals a remarkable carbonation behavior of SrO. As SrO is very hygroscopic it transforms almost immediately to $Sr(OH)_2$ when getting into contact with the moistened CO_2. It consecutively hydrates yielding $Sr(OH)_2{\cdot}H_2O$. Parallel to this hydration a slow continuous carbonation reaction starts which is followed by a significantly accelerated carbonation step after the $SrCO_3$ phase reached an amount of 10 wt%. This fast carbonation completes the full conversion into $SrCO_3$ within a short time interval.

We conclude, that the reaction starts at the surface of the particles thus forming a carbonate layer, which retards the CO_2 diffusion into the core of the particles. This is the presumable reason for the slow reaction kinetics at the beginning of the carbonation process. At a certain point the comparatively fast transformation of $Sr(OH)_2{\cdot}H_2O$ into $SrCO_3$ starts, which can be explained by the formation of micro-cracks and microstructural changes including fragmentation of the particles.