ACTIVATION OF SLAGS FOR THE CAPTURE OF CO$_2$

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Nowadays the slags have demonstrated to be competitive for the CO$_2$ capture by carbonation process. However, studies show that the diffusion of CO$_2$ is the determining step in the sorption kinetics by slags. One disadvantage of the process is the limited number of carbonation/decarbonation cycles. To increase their performance, in this work the hydrothermal activation of blast furnace slags (BFS) was achieved. The BFS was constituted by Ca (28.5%), Si (14.8%), Mg (5.7%) and Al (4.7%), principally. Akemarnite (Ca$_2$MgSi$_2$O$_7$) was the principal crystalline compound identified by XRD. The alkaline activation was achieved in a hydrothermal system with different concentrations of NaOH (from 1 to 3 M) at 90 and 120° C. The carbonation/decarbonation process was achieved in a TGA equipment at 500-900° C.

The results of activation revealed the formation of calcium metasilicate and magnesium metasilicate as well as amorphous material. Calcium and magnesium metasilicate are constituted by small particles with a relative greatest surface area and accessible active sites to form calcium and magnesium carbonate. In fact, the capacity for forming carbonates was higher in the case of the activated BFS. This last observation is explained by the new structural position of Ca and Mg in the silicates, which facilitates the entrance of CO$_2$ molecules. When the BFS was activated, the rate of carbonation was not significantly affected by the Ca and Mg diffusion. The results show the possibility to increase the capacity to capture CO$_2$ by the chemical modification of a waste generated in the industry.