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Influence of the Milling Conditions on the Thermal Decomposition of Bayer Gibbsite

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ABSTRACT

A synthetic gibbsite ($\text{Al}(\text{OH})_3$) produced by the Bayer process was mechanically activated by attrition milling for 24 hours with various grinding ball-to-powder ratios (BPR=5, 10 and 20). Changes in its structure were studied by thermal analysis and X-ray diffraction. As a result of increasing ball-to-powder ratio, the grain size of gibbsite decreased while its specific surface area increased. Only for these materials, the formation of nanocrystalline boehmite ($\text{AlO}\cdot\text{OH}$) and amorphous aluminium hydroxides was also observed. Upon having been heat treated between 200 – 1200°C (2 hours), boehmite was detected at the temperature range of 200 and 350°C for the BPR10 sample, while the boehmite of BPR20 was transformed to γ - Al_2O_3 at 500°C. Further, only α - Al_2O_3 was detected at 1200°C for all samples. Finally, combining the TG-DSC, XRD and SEM results, it was proposed a mechanism for the thermal decomposition of the non-milled and milled samples.

Key words: Gibbsite; milling; mechanical activation; amorphization; thermal behaviour.

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