

## Dehydration behavior and the derived delamination effect of boehmite.

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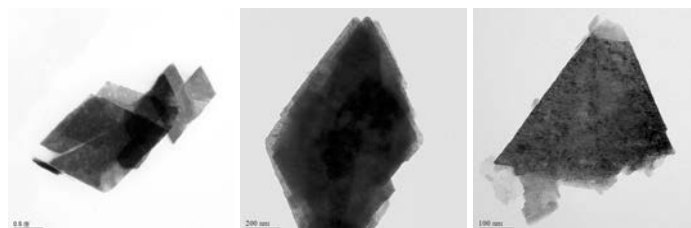
### Abstract

**The** topotactic transformation of boehmite ( $\text{AlOOH}$ ) to  $\gamma$ -alumina ( $\gamma\text{-Al}_2\text{O}_3$ ) that taking place under heat treatments has been proposed to fabricating authigenic  $\gamma\text{-Al}_2\text{O}_3$  flake powders based on its layered crystal structure. This proposal is based on two major mechanisms [1,2]. Firstly, the layered structure can be delaminated by the vapor pressure generated during the dehydration of boehmite by heat treatments. Secondly, a shearing stress can be provoked between the layers through the aluminum migration necessity that occurs during the reforming process of the layered stacking from ABAB in boehmite to ABCABC in gamma alumina. The shearing strain can also initiate the delamination of the stacked layers. Differential thermal analysis (DTA) technique with six heating rates was employed to determine the endothermic temperature ranges that induced by dehydration of boehmite, at the end of which  $\gamma\text{-Al}_2\text{O}_3$  being formed. Selected temperatures in the temperature ranges then used to calcine samples for examining delamination effects Evaluation were performed using techniques of measuring the changes in specific surface area (BET- $\text{N}_2$ ) accompanied with the transmission electron microscopy (TEM) examinations of the calcined samples. All  $\gamma\text{-Al}_2\text{O}_3$  obtained at the temperature range between 525 °C and 640 °C with the six heating rates appear to have similar ultimate BET values, being 85-90 $\text{m}^2/\text{g}$ . The value is equivalent to a flake particle with 7 nm in thickness. However, the TEM examination performed here reveals that the  $\gamma\text{-Al}_2\text{O}_3$  particles obtained with slower heating rates may bring about an euhedral platelike morphology. While using a fast heating rate, it gives rise to the particle fragmentation. The BET value increases with the rise of dehydration rates. The values of BET to wt% of  $\text{H}_2\text{O}$  removal are 2.26 and 1.26, respectively, with heating rate lower and higher than 1.0°C/ min. The investigation also finds that the calcined boehmite transforms to  $\gamma\text{-Al}_2\text{O}_3$  when the dehydration is exceeding 55% of weight loss and the BET values has been above 85  $\text{m}^2/\text{g}$ .

### References

- [1] P. Raybaud,† A.-E. Gobichon, B. Rebours, P. Euzen, and H. Toulhoat “Theoretical Study of the Dehydration Process of Boehmite to  $\gamma$ -Alumina” J. Phys. Chem. B 2001, 105, 5121-5130
- [2] G. Paglia, C. E. Buckley, A. L. Rohl, R. D. Hart, K Winter. A. J. Studer, B. A. Hunter, and J. V. Hanna, “Boehmite Derived  $\gamma$ -Alumina System. 1. Structural Evolution with Temperature, with the Identification and Structural Determination of a New Transition Phase,  $\gamma'$ -Alumina” Chem. Mater. 2004 16, 2, 220-236

### Figures



**Figure 1:** TEM micrographs about delaminating effect of (a)(b) 1.0°C/min & (c) 20°C/min.