Study of dispersions of non-spherical colloidal aggregates of boehmite

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In the catalyst carriers industry, the production of alumina powders can be achieved by spray-drying boehmite suspensions, this aluminium oxyhydroxyde being often used as precursor for various types of alumina catalyst supports. Well-peptized boehmite (AlOOH·nH2O), is composed of anisotropic particles bearing an electric charge [1]. In the past decade, it has been shown that the properties of the dry powder strongly depends not only on the processing conditions but on physico-chemical of the sprayed suspensions [2]. For instance, different grains morphologies (doughnut-shaped grains, hollow spheres,…) as well as various dry grains properties (textural properties, mechanical resistance,…) may be achieved by tuning the physico-chemical properties of the suspension [2]. Moreover, from a practical point of view, it is important to spray-dry suspensions with the highest solid contents but while keeping low viscosities.

The goal of this communication is to investigate the physico-chemical and rheological properties of aqueous boehmite suspensions. Two industrial boehmites have been studied, the difference between the two is the synthesis route. Suspensions were prepared by peptising the boehmite by nitric acid followed by a dialysis against distilled water. Then, the particles have been characterized by combining DLS, SAXS and TEM analysis. We show that the particles in suspension are aggregates of boehmite elementary crystallites, these aggregates are slightly anisotropic (aspect ratio between ≈ 3 and 4) and tridisperse (≈ 5, 20 and 60 nm). In order to investigate the behaviour of dispersions of non-spherical colloidal aggregates of boehmite, several dispersions for the two studied boehmite were prepared by osmotic stress for different ionic strengths. For ionic strengths comprised between 10^{-4} and 2×10^{-3} M, we evidence a liquid-gel transition for a constant volume fraction. For the boehmite synthesised by alumina salts precipitation, the volume fraction of the gelation is 2%. For boehmite derived from aluminium alkoxides (Pural SB3), the volume fraction corresponding to the transition is about 1%. For ionic strengths higher than 2×10^{-3} M, the liquid-gel transition is shifted towards lower volume fraction (0.3%). We present a study of the rheological properties of both liquid and gelled dispersions.

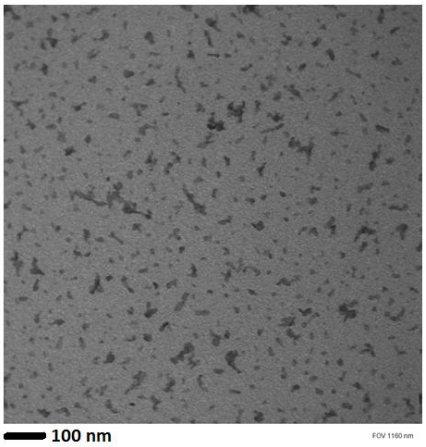

Figure 1 TEM photograph of boehmite (Pural SB3) suspension (magnification: 260kx).

[1] F. Mange, D. Fauchadour, L. Barré, L. Normand and L. Rouleau, *Colloids and Surfaces A*, 1999, **155**, 199.
[2] S. Lyonnard, J.R. Bartlett, E. Sizgek, K.S. Finnie, Th. Zemb and J.L. Woolfrey, *Langmuir*, 2002, **18**, 10386.