INFLUENCE OF THE DISPERSION CONDITION ON THE PARTICLE SIZE DISTRIBUTION ANALYSIS OF AN ALUMINA POWDER

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Abstract - It is well known that colloidal powder particles (between 1 mm and 0.001 mm) tend to agglomerate due to electrostatic forces. Then assuring an optimal dispersion condition is essential for good particle-size analysis results, since aggregates or weak agglomerates can be measured as single particles. In this paper the particle size distribution of an alumina powder A1000SG (ALCOA) was measured using distinct dispersion procedures. Distilled water was used as dispersant liquid in the pure state and with additives (citric acid and Duramax D-3005). The time of supersonic application was also varied. Particle size analysis was accomplished by laser scattering technique and the dispersion condition was evaluated through zeta potential. The results showed that the Duramax's electrosteric activity is more efficient than citric acid's electrostatic force. Although useful, the ultrasonic application was not good enough to assure an optimal dispersion, at least for the material tested here.

Introduction

Knowing mean particle size and its distribution is a major concern regarding production process involving particulate materials. Mechanical resistance, density, thermal and electrical properties of finished products are strongly affected by particle size distribution [1]. Doing particle size measurement in right way is a major concern, regarding that economical losses can be resulted from low quality products and high rejection rates.

Various particle size determination techniques have been developed, however a lot of difficulties inherent to each technique arise in order to obtain accurate values [2-6]. For that reason reproducibility becomes more relevant in process control, although accuracy is demanded in research and development activities [7].

The reproducibility of a powder size measurement is mostly influenced by two factors: sampling and powder dispersion. A suitable sample must represent accurately the powder bath in question and above all must be well dispersed; otherwise the size that will be measured is not the one from single particles but from weak aggregates or agglomerates of particles.

Fine particles with colloidal dimensions show a strong tendency to agglomeration, keeping close together by electrostatic forces. In a liquid medium, the high specific surface area of these particles improves the action of superficial forces causing agglomeration. [8]. To assure a good dispersion, repulsion forces should be stronger than attraction forces. Repulsion can be originated from two events: electrical charges at particle surfaces produced by the interaction between the particle surface and liquid medium, forming a double electrical layer (electrostatic stabilization); adsorption of long-chain polymers that impair mechanically the approximation of the particles [8,9].