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Heating rate effect on the Synthesis of alumina nanoparticles

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Abstract – The (alpha)-alumina is the most stable form of alumina and consists of hexagonal crystals or rhombic. It is one of the hardest materials known and widely used as an abrasive in both the natural form and synthetic. In this work, the powder of alpha-alumina was synthesized by Modified Pechini Method in different heating rates and residence time in oven. The samples were characterized by XRD, BET, EDX and SEM techniques. The powders were calcined to 1100 °C and the best result was obtained under conditions of heating rate of 5 ºC/min and time in oven for 60 minutes.

Several studies on the alpha-alumina have been carried out to obtain powders with nanosize particles and high surface area. This material is widely used in industrial applications and in catalyze with catalytic support due to its high tensile strength, high elastic modulus, chemical stability and oxidation resistance, radiation resistance, resistance to attack by molten metal and non-oxide materials, low thermal conductivity and good thermal insulation [1].

In this paper, the powders of alpha-alumina were synthesized by Modified Pechini method, with the use of gelatin, in order to verify the effect of heating rate and the residence time in oven on structural, morphological, size of crystallites and surface properties. The powders were calcined at 1100 ºC and at heating rates of 5, 10 and 15 ºC/min and in the residence time in oven 30, 45 and 60 min. The resulting powders were characterized by XRD, BET, EDX and SEM techniques.

According to difratogramas x-ray shows that the samples in the different ramps showed better results of the training phase and crystallinity over time of 60 min. But is still a need for a greater residence time in oven. Among the results, which showed better crystallinity and phase formation of alpha-alumina was the sample with ramp of 5 º C / min and time in oven for 60 min. The method of synthesis used showed that it is effective in the synthesis of ceramic powder of alpha-alumina.

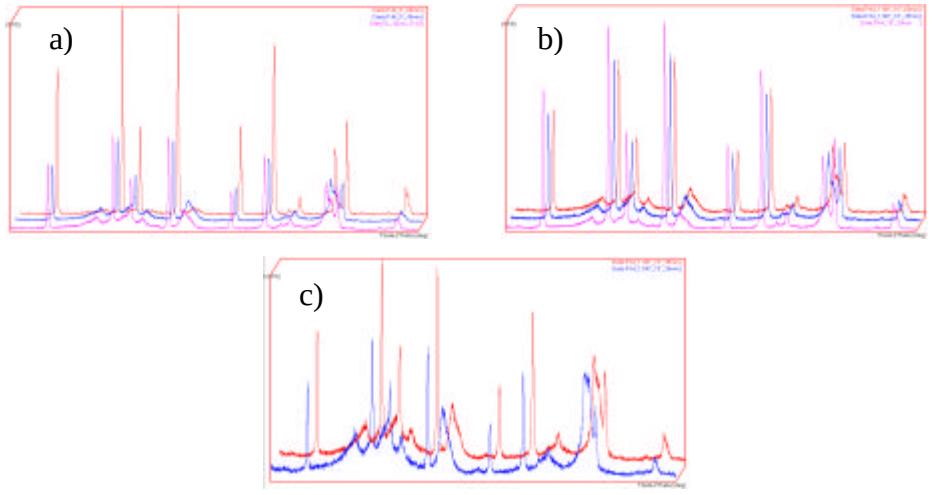

Figure 1: Difratogramas x-ray of the samples calcined to 1100 ºC/ min in times of 30, 45 and 60 min and heating rate a) 5 ºC/min, b) 10 ºC/ min e c) 15 ºC/ min.

[1] Z. Wu et al. Journal of Alloys and Compounds (2008).