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Calcinations Effect on The Grain Size Distributions Al_2O_3 Powder

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Abstract. Fine of Al_2O_3 Powder was calcined at 200°C, 400°C, 600°C, and 800°C respectively for 2 hours under static air, x-ray diffraction, optical microscope and grain size distribution were done to analysis the resulting data after calcinations process. Batter particle size was achieved at 800°C of value (0.486) μm, while batter particles mean value of size 7.18 μm was found at 400°C. SEM micrographs shows that the agglomerate particles were vanished due to the calcinations process.

Key words : Powder **,**Calcinations , particle size .
PACS: 81.07.Wx

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INTRODUCTION

They are many powder technologists who still assume that sample selection procedure is unimportant. This analysis being frequently presented with hastily taken, biased samples on which great deal of attention to derive precise result which don't reflect the characteristics of the bulk powder [1]. It is essential that the samples selected for measurement should be representative of the bulk in grain size distribution and the relative of the various constituents, irrespective of whether a physical or chemical assay is to be carried out, since these characteristics are frequently interdependent the magnitude of the problem may be realized when one considers that the characteristics of many tons of material are assumed on the basis of analyses carried out on grams or even milligrams [2].

It must be born in mind that the size of products from powder technology is bound to be limited, both by handling strength considerations during manufacture and by economic limitations upon equipment size. It must be further borne in mind that only relatively large numbers of a product will justify its manufacture by mass production [3].

At present some of this process products cannot be made by any other process, other may compete favorably with their counterparts made by other method, because the close tolerances eliminate the necessity of any further processing [4].

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EXPERIMENTAL WORK

The material used in this work was Al_2O_3 powder (from B D H-England). In the average sphericity of 0.59 and surface area 29 m/g patches of 10 g were prepared for each calcinations process.

Calcinations were performed at various temperature ranging from 200 to 800 ^oC at heating rate 10 ^oC /m in For 2 hours, under static air. The initial grain size for starting samples and the final grain size distribution were achieved by using coulter method (laser particle size analyses).

X-ray diffraction analysis were performed for the calcined specimens using the patterns obtained and analyzed the height of the x-ray diffraction peaks which used to identify the phases according to the ASTM file no. 43-1484.

The grain shape was determined by using scanning electron microscope for all the particles that were calcined from 200 to 800^oC for 2 hours under static air.

RESULTS AND DISCUSSION

Crystal structure and particle size distribution for Al_2O_3 powder were detected before and after calcinations process. Coulter method, Optical microscopy were used to detected the powder situation.

The resultant data obtain shows clearly the particles decreasing in size after calcinations in static air for 2 hours and for all calcinations temperature, comparing with the reference (Al_2O_3) powder before calcinations of mean particle value (8.48 μm), and achieved minimum mean value (7.18 μm) at 400^oC, while others 200^oC, 600^oC, 800^oC, ranging between 8 - 7.32 μm as shown in table 1. Better particle size was found at 800^oC of 0.486 μm. The crystal structure analysis for the powder before and after calcinations indicates no any changes.

The calcinations behavior with respect to particles amount can be seen from Fig.1, which declare the particles amount between 50% to 75% having size at 6.78 μm to 12.5 μm calcined at 400 ^0C, While before calcinations the total particles amount sizes is 20 μm to 27.5 μm .

Optical micrographs for both Al_2O_3 before and after calcinations were focused as shown in Fig. 2a and 2b. The large particles clusters before calcinations can be shown Fig. 2a and small individual particles can be seen after calcinations at 400^oC in Fig. 2b.

The particles reduce in size caused by the slow calcinations rate which lead to formation of many nuclei and because the nucleation process stops abruptly and because all the particles grows at the same rate the final particles are μm [5] all. The cooling begins quicker than the calcinations, so particles that collide due to Brownian motion do not sinter to form hand agglomerates [6].

TABLE 1 .Al_2O_3 powder calcined at different calcinations temperature with respect to the particles mean value.

Calcinations Temperature ^oC	Particles mean values (µm)
25	8.480
200	7.299
400	7.188
600	7.32
800	7.30

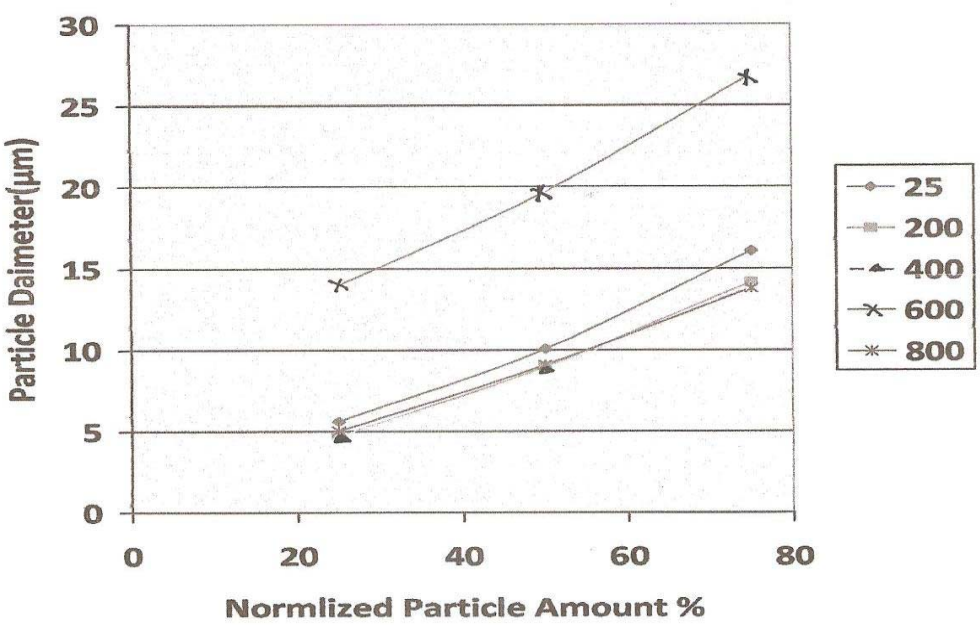

FIGURE1. Particle diameter with respect to particle amount calcined at different calcinations temperature

(a) (b)

FIGURE 2. SEM micrographs for (a) Al_2O_3 powder and (b) Al_2O_3 powder calcined at 400 ^oC for 2h. in static air

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