

## Low Temperature Photosynthesis of Bi<sub>2</sub>O<sub>3</sub> Nano Powder

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### Abstract

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Using photolysis method, bismuth oxide particles in the nano range were successfully prepared. The results showed prepared particle with high purity and this indicates the importance of this method. The synthesized particles characterized using XRD and AFM techniques. The results from XRD obtain prepared alpha phase with monoclinic structure while AFM result showed synthesis particles with 38 nm average.

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### Introduction

Wide applications for Nano Bi<sub>2</sub>O<sub>3</sub> were used as a catalyst, capacitor, additive in paints and gas sensors. Because of the compounds of Bi<sub>2</sub>O<sub>3</sub> has structure face-centered cubic, it has high conductivity compare with all conductors oxides and it is the best solid electrolytes. Four phases of Bi<sub>2</sub>O<sub>3</sub> were existed:  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$ . Many methods were used to prepare it such as sol gel, chemical precipitation and hydro thermal methods [1-5]. In this paper, a new method was studied to prepare the particles called photolysis method. According this method, UV irradiation [6-11] works as a reduction reagent to prepare the nano surface.

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## Experimental

### *Characterization*

AFM and XRD were used to character the image surface, average and crystal system of the nanoparticles.

### *Synthesis of Bi<sub>2</sub>O<sub>3</sub> nonoparticles*

5 g of bismuth chloride dissolved in 100ml of ethanol and photolysis it using irradiation system as shown in Figure 1 for 2hr until brown precipitate appears. After that burned the precipitate for 1hr at 400°C until yellow powder appears.

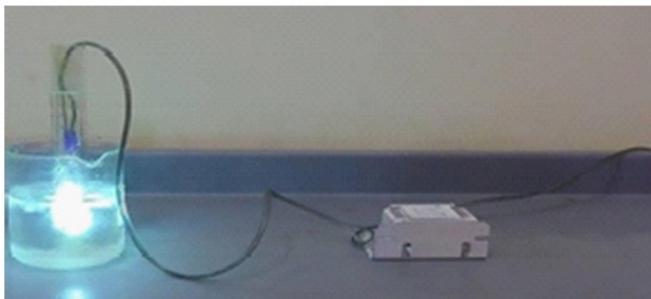
## Result and Discussion

The average of particles appeared in Figure 2. The results show prepared particles in nano range.

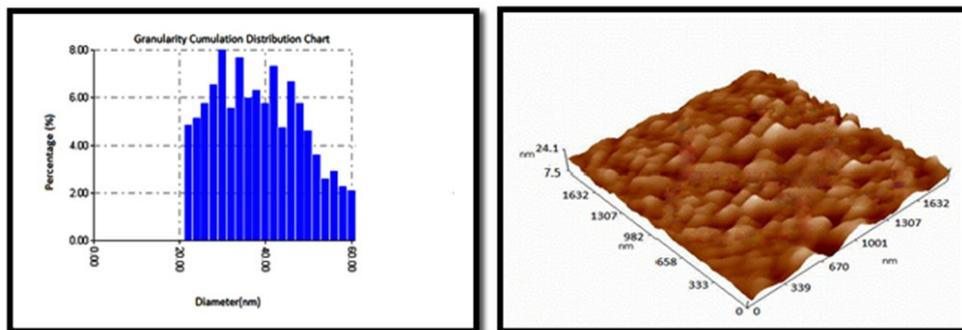
The crystal size of nanoparticles was determined by using Debye-Scherrer formula by following equation [12]:

$$D = k \lambda / \beta \cos \theta,$$

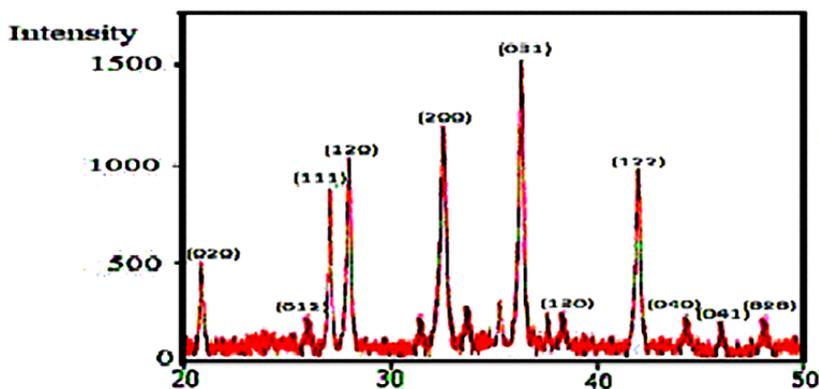
where  $\lambda$  is the wavelength of the Cu-K $\alpha$  radiations,  $k$  is Scherrer constant,  $\beta$  is the full width at half maximum and  $\theta$  is the angle obtained from 2 values corresponding to maximum intensity peak in XRD pattern. The result from equation show prepared particle in nano size (30nm).



**Figure 1.** Irradiation system (125W).



**Figure 2.** 3d image of AFM and granularity cumulative distribution chart for  $\alpha\text{-Bi}_2\text{O}_3$ .



**Figure 3.** XRD of  $\alpha\text{-Bi}_2\text{O}_3$ .

The structure of alpha phase of bismuth oxide nanoparticles was characterized by using XRD technique that prepared by photolysis methods. Figure 3 was shown the pattern of alpha phase and miller index of the powder and it showed that the nanoparticles have monoclinic structure according standard card (JCPDS00-041-1449).

## Conclusion

By simple photolysis method, bismuth oxide nanoparticles have been successfully prepared. The checking of the AFM and XRD were showing us the composition of  $\text{-Bi}_2\text{O}_3$  with 38nm.

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