ALUMINUM /IRON MIXED OXIDES OBTAINED BY CO-PRECIPITATION METHOD

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Abstract

In last years, various synthesis methods have been used for production of nanomaterials, composites/nanocomposites. For preparation of catalysts are used different methods such as hydrothermal, sol-gel and co-precipitation. Because Fe_2O_3 -Al_2O_3 mixed oxide system offer many advantages, its important to know if the combination of two transition metal oxides can affect their stoichiometry, surface, catalytic properties and textural structure. The aim of this study is represented by mixed of oxides who was obtained from the synthesis of aluminum nitrate and iron nitrate who was prepared by the co-precipitation method. Then, the characterization studies about the compounds obtained such as hematite, magnetite and the alumina were performed by X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and UV-Vis spectrophotometry.

Introduction

Aluminum oxide is considered an important chemical who was noticed such as good product with different properties like strength product resistance [1], also have a chemical, electrical, optical and thermal properties [2]. Based on oxidation and reduction, co-precipitation on Al with Fe oxides respectively hydroxides induces the dissolution of Fe from the phrases containing Fe and its re-precipitation as Fe-Al [3]. The treatment of two oxides at high temperatures is known to produce new crystalline structures [4]. Iron-substituted alumina, which is a different mixed oxide has been the subject of various investigations into its use in treating industrial effluents, this issue attracting more and more attention today [5].

Experimental

Co-precipitation is a fairly exploited method for obtained iron oxides (nanoparticles) and aluminum oxides. For this study was used aluminum nitrate who was dissolved in ethyelene glycol under the influence of temperature increase, after two hours of stirring the sollutions was ajusted with base. For the second solution was used iron nitrate with distilled water. After washing, the samples were calcined at 800° C (fig.1). The aim of this study was to obtained oxides in different forms such as Fe_3O_4, α-Fe_2O_3 and γ- Fe_2O_3 and Al_2O_3.

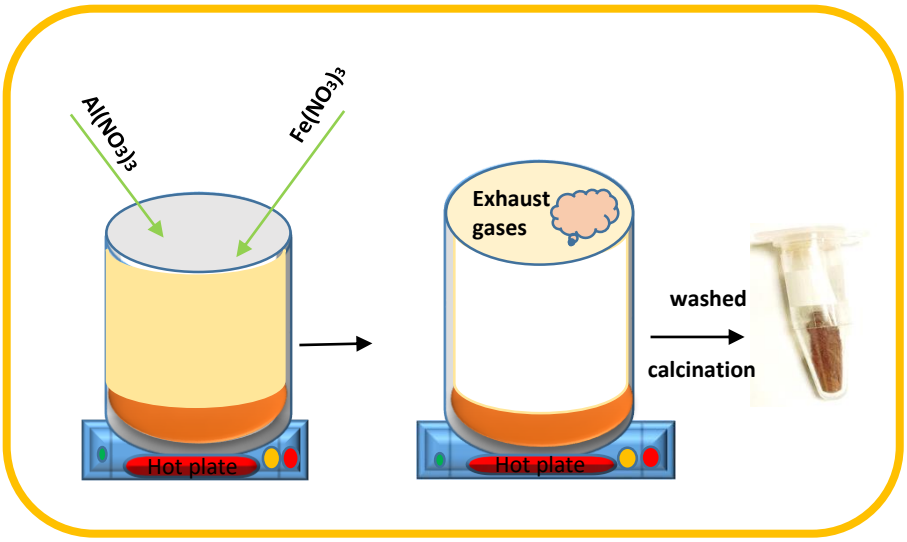

Figure 1. Schematic reprensations of co-precipitaion process

Results and discussion

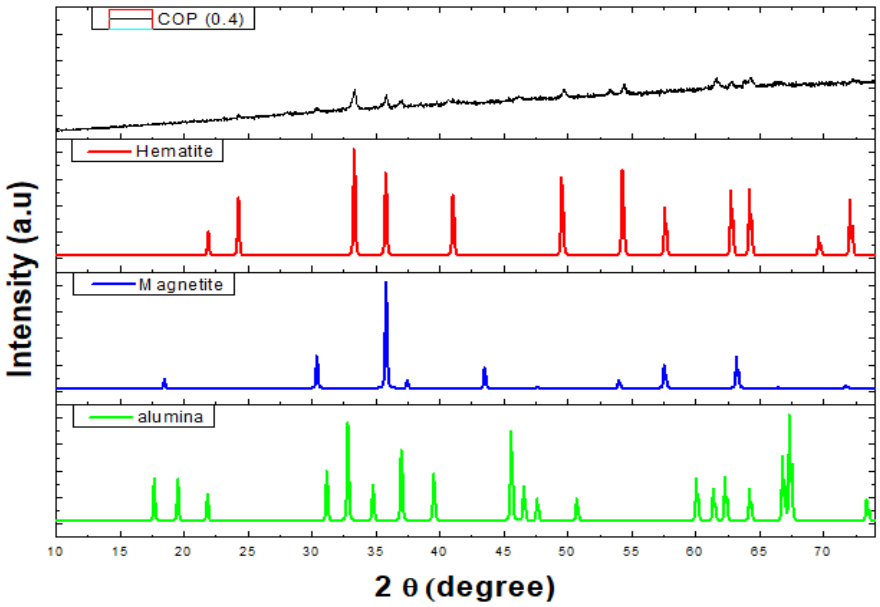

Figure 2. Diffraction peaks in the XRD pattern of red line- hematite (Fe_2O_3); blue line magnetite-Fe_3O_4, green line- aluminum oxide (Al_2O_3);

In this study, from the diffraction spectra results that the iron oxide exists in different phases such as hematite (α-Fe_2O_3), maghemite (γ-Fe_2O_3) and magnetite (Fe_3O_4) with different Fe valence, all of them being known for their low cost and non-toxicity. Diffraction patterns for the sample sintered at 800 °C (by calcination process) were identified as a mixture of Fe_2O_3 and Al_2O_3.

Through the precipitation method, the mix of nitrates led to the obtaining of hematite who representing the largest amount of compound obtained and aluminum oxide with a tetragonal structure resulted.

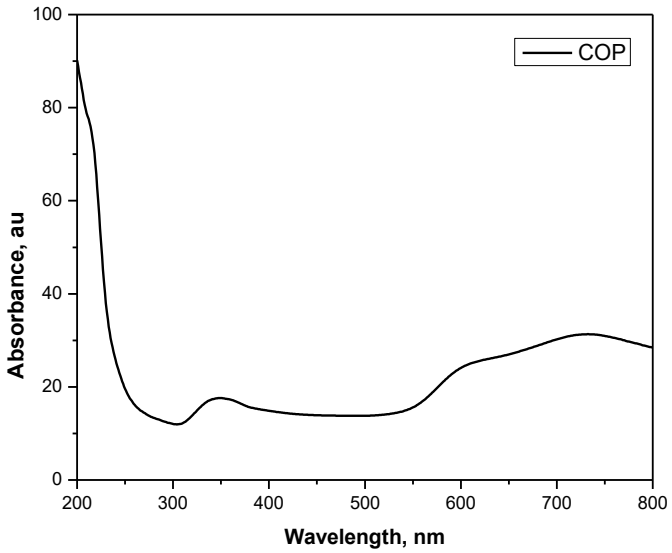

Figure 2. UV-Vis spectrum of mix of aluminium oxide and iron oxide by co-precipitation method

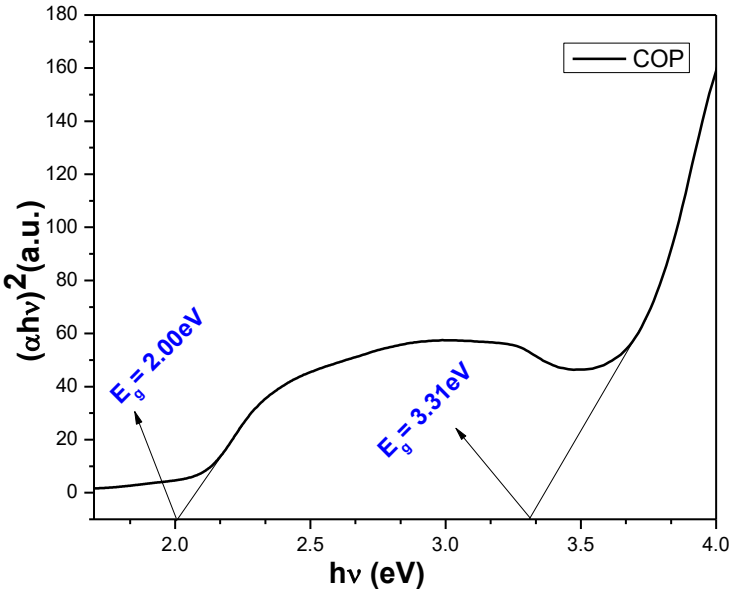

Figure 3. The value of the bandgap

Comparing with the studies of the literature where the value of the band gap is around 2.35 eV for iron oxides [6], [7], we can see that it had a slight decrease (2.0 eV) for iron oxides and (3.1) aluminum oxide [8], using the coprecipitation method (as a synthesis method) which corresponds to studies from the literature.

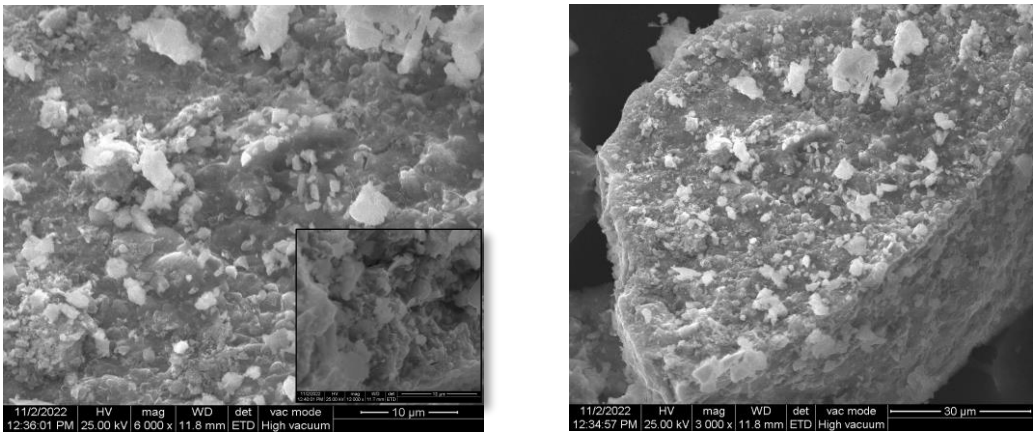

Figure 4. SEM images of the surface of particles sintered at 800 °C

The SEM analysis of the coprecipitation method of aluminum and iron oxides shows that iron oxide exist as clustered and aggretate shape (this prove the presence of hematite) and the surface of aluminum oxide is rough.

Conclusion

This study shows that ions of aluminium metal incorporated into iron oxide nanostructures by co-precipitaion method. The optical band gap, may lead to an enhanced photo catalytic activity.

Acknowledgements

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