PH AND MICROWAVES IN SEMICONDUCTOR OXIDE MORPHOLOGY: TIO2 AND ZNO

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Abstract. In this work different morphologies of TiO_2 and ZnO are obtained, by means of a simple methodology assisted by microwave, by varying the pH and the time of irradiation with microwaves. The morphology was characterized by SEM, obtaining for the TiO_2 hexagonal cylinders and rectangular cylinders by varying the time of irradiation with microwaves, 10 and 30 min, respectively, and in the case of ZnO nanoflowers and heptagonal cylinders are obtained.

Keywords: Morphology, microwaves, nanoflowers, cylinders

Introduction.

The practical applications of the materials depend on some physicochemical properties such as adsorption, photocatalytic activity, thermal stability, among others [1]. In the field of photocatalysis others must possess a large surface area and avoid the processes of recombination of charge. Many studies show that one way to avoid the processes of recombination of electron-hollow pairs is by exposing the most reactive facets of the material [2,3], which implies a control in their morphology. The synthesis of materials with a specific morphology has become a challenge, being able to develop several methodologies for this purpose, besides to identify some parameters that play a very important role in obtaining the desired morphology [4].

In this work we show a simple methodology assisted by microwaves to obtain different morphologies of TiO_2 and ZnO by varying the pH and the time of irradiation with microwaves.

Experimental part.

Synthesis of TiO_2

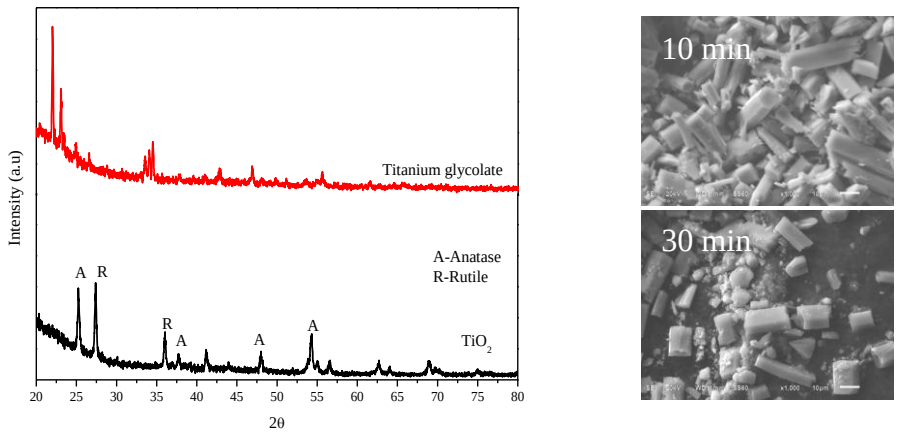
The synthesis of TiO_2 is carried out as follows: 15 mL of ethylene glycol and 4 mL of titanium butoxide are placed in a ball flask. The solution is mechanically agitated for 10 min and then treated in microwave for 10 and 30 min, obtaining a white suspension (titanium glycolate), which is washed with hot methanol and water. The powder thus obtained is thermally treated at 600 ° C for 2 hrs, thus obtaining TiO_2.

Synthesis of ZnO

The synthesis of ZnO was carried out as follows: in a 100 mL ball flask 15 mL of 1-octanol were added and heated at 80 ° C for 10 min. Then 1 g of $ZnCl_2$ is added while maintaining the stirring for 10 min at a temperature of 80 °C. The NH_4OH is then added until a pH of 8 and 10 is obtained, maintaining stirring for a further 10 min. Finally, the microwave heating treatment is given for 5 min and the obtained solid product is rinsed with methanol and water. The powder thus obtained is given a heat treatment at 600 °C for 2 hrs. The OZnO-01 samples were obtained for pH 8 and OZnO-02 for pH 10.

Results.

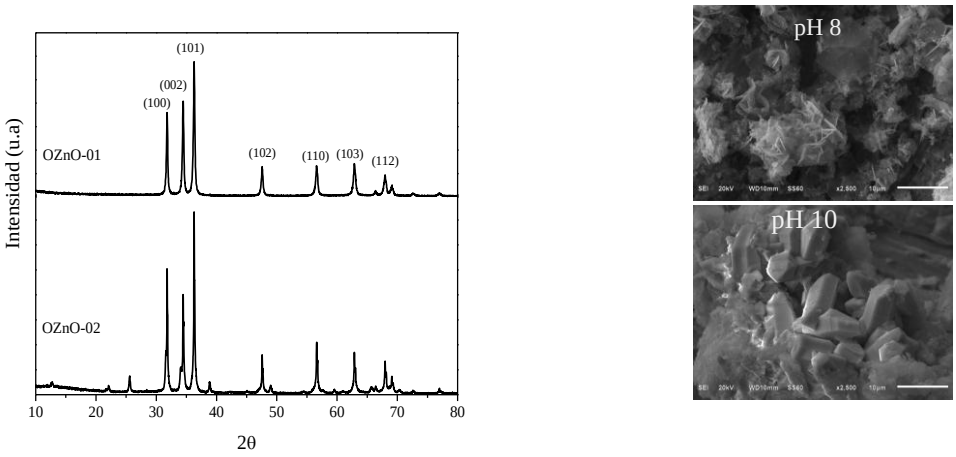
Figure 1a shows X-ray diffractograms (XRD) for the titanium glycolate and TiO_2 obtained. Titanium glycollate is formed by mixing the ethylene glycol with titanium butoxide and the microwave irradiation time (10 and 30 min) does not cause its decomposition to TiO_2, so it is necessary to heat treatment to obtain it. Figure 1b shows the morphologies obtained by varying the time of irradiation with microwaves, obtaining with 10 min of irradiation hexagonal cylinders of approximately 10 μm of radius and for 30 min of exposure to microwaves are obtained rectangular cylinders of approximately 10 μm of width.



a) b)

Figure 1 – a) XRD of titanium glycolate and TiO_2 obtained. b) SEM images of the remaining TiO_2 morphologies at two different microwave irradiation times, at 10 and 30 minutes

In Figure 2a we can see the XRD of the zinc oxides obtained after the heat treatment, which correspond to the data sheet of crystalline ZnO in the hexagonal phase. An important aspect of analyzing the diffractograms is the influence of the reaction conditions on the crystalline habits of the final product. This suggests the possibility of controlling not only the direction of preferential growth but also the morphology varying the solvent, as well as the pH. The SEM images of these photocatalysts confirm the structural differences mentioned, as can be seen in Figure 2b, where we can observe the formation of nanoflowers for pH 8 and heptagonal cylinders for pH10.



a) b)

Figure 2 – a) ZnO XRD obtained with different pH. b) SEM images of the morphologies obtained from ZnO at two different pH values (8 and 10)

Conclusion.

It is possible through a simple microwave assisted methodology to have control over the morphology of TiO_2 and ZnO by varying parameters such as microwave irradiation time and pH. It is expected that having smaller variation intervals can be proposed a mechanism of growth that would indicate how these changes in morphology occur. However, these are proposed as a future work, as well as the effect of these morphologies in a practical application, specifically in the photocatalysis.

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ОСОБЕННОСТИ ФОРМИРОВАНИЯ И ПОСЛЕДУЮЩЕГО УДАЛЕНИЯ ИЗ КРОВОТОКА ЦИРКУЛИРУЮЩИХ ИММУННЫХ КОМПЛЕКСОВ В ПРОЦЕССЕ ПИЩЕВАРЕНИЯ

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Аннотация. С помощью метода динамического светорассеяния мы обнаружили, что при пищеварении в крови крыс и человека образуется значительное количество иммунных комплексов. У крыс пищевые ИК практически сразу фильтруются в печени, не циркулируя с кровотоком по организму. У человека уровень пищевых иммунных комплексов в крови нарастает в течение 3.5 часов после приема пищи, затем происходит их постепенное удаление в течение 7-8 часов. При этом в период времени, когда уровень пищевых комплексов в крови достигает своего максимума, их размеры и вклад в суммарное рассеяние у различных доноров очень близки по своим значениям. Обнаружено, что в процессе пищеварения у человека изотипический состав иммуноглобулинов в ЦИК изменяется, становясь разнообразнее.

Обсуждаются возможные причины и молекулярно-клеточные механизмы описанных явлений.

Ключевые слова: изотипы иммуноглобулинов, метод динамического светорассеяния, пищеварение, циркулирующие иммунные комплексы.