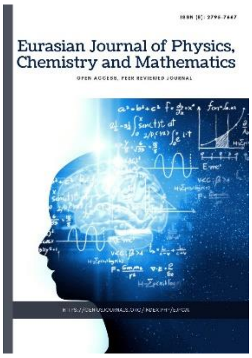

Structure and Morphology of TiO2 nanoparticles

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ABSTRACT

In this paper was synthesis of TiO2 nanoparticles from TIP in ethanol solution . TiO2 was prepared is anatase from structure and information product from XRD and SEM . TiO2 nanoparticles was prepared study structure and morphology for different thickens 50,80 and 130 nm

Keywords: TiO2, XRD,SEM

Introduction

Several types of published study have recently focused on the manufacture and application of Titanium dioxide. This is because to its inexpensive cost, good photo-induced corrosion resistance, and chemical stability[1-4]. It's non-toxic, has a high oxidizing power, a 3.2 eV energy bandgap, and maximum light scattering with almost no absorption. Rutile (tetragonal), anatase (tetragonal), and brookite (orthorhombic) are the three distinct crystalline forms of TiO2[5-10].

The nature of the starting material, sol composition, deposition process, and calcination temperature all influence the creation of each crystalline phase[11-14]. Calcination can change TiO2 bulk from an amorphous to a crystalline state[15-20].

The surface extension and kind of exposed crystal faces have a big impact on the function of crystalline nanomaterials, especially those with anisotropic forms due to few(er) symmetry structures or synthesis circumstances. Chemical reactivity, catalysis, rheology, luminescence, and Photocatalytic activity are only a few examples[21-25].

Because photocatalytic reactions occur at the catalyst–substrate interface, the "golden standard" among photocatalysts, titanium dioxide (TiO2), has properties that are highly impacted by the structure, surface, and morphology of nanocrystals (NCs) [26-30].

It has a tetragonal crystal structure in comparison to anatase, the most photocatalytically active titania polymorph and surface energy estimates indicate a square bipyramid that is slightly truncated, revealing 101} and {001} facets only[31-33].

Anatase is also the most stable polymorph below 30 nm at the nanoscale, according to research [34-35].

Nonetheless, quantitatively quantifying the morphology and facet area, as well as elucidating their relevance in this size range, is still a work in progress [36-37].

When compared to the most stable facets, NCs with extended 001 facets have been discovered to be particularly desirable, since the greater number of under coordinated Ti atoms (active sites) present defines a higher reactivity (101 or 100)[38-40].

2. Materials and Methods

The TiO2 solution was made utilizing Aldrich Company's Titanium (IV) isopropoxide (TTIP) as a precursor material, which had a purity of 97 percent. GCC provided pure ethanol (EtOH) for use as a solvent (99.9% purity).

2.1. Synthesis of TiO_2 nanoparticles

In a beaker, 5 mL acetic acid was dissolved in 250 mL deionized and distilled water for this experiment. The hydrolysis catalyst was the combined solution. Then, in a syringe, 5 mL of the TTIP precursor was added to the aforementioned solution right away. The resultant solution was immediately sonicated at 70 °C for three hours before being dry on a hotplate at 70 °C for around one day .

After that, a mortar was used to crush the dried sol-gel product into a fine powder for analysis. The coarsely pulverized sample was heat treated for 3 hours at 200° C in a muffle furnace. It was possible to obtain a yellow white powder [41-42].

2.3. Characterization

XRD investigations were performed in a Bruker D8 Advance diffractometer at room temperature using CuK1 radiation ((0.154nm) (RT. (The XRD was set up at 40 kV and 30 mA with a scanning angle range of 20-80o and a 0.02° increment. The IR spectra of the samples were obtained using the KBr technique on an FTIR spectrophotometer (IRAffinity-1S, Shimadzu.(Compositional studies were performed using a Jeol/JSM-6490 scanning electron microscope (SEM) operating at 20 kV and equipped with an energy dispersive X-ray (EDX) detector. The samples were characterized using a Tecnai F20 FEG-S/TEM operating at 200 kV.

A Chromtech spectrophotometer CT-8600 was used to evaluate the absorbance measurements. A Jasco Spectrofluorometer FP-8500 was used to measure photoluminescence (PL) at room temperature. A Rayleigh UV-Visible Spectrophotometer, UV1800, was used to determine the concentration of phenol solutions.

2.4. Degradation of phenol

The photocatalytic activity was conducted in a batch reactor using an Illuminator LuzChem LZC-4V photoreactor with 14 lamps (Sylvania F13T8 13W, Cool White, 412 K Color Temperature) emitting in the visible region between 400 and 700 nm. With a UVX radiometer under continuous illumination, the energy density of the light irradiation on the surface of the sample was 4.5 J/cm2.

The synthesized materials were utilized to degrade phenol solution as a catalyst. The phenol was first tested in the absence of the catalyst to see how stable it was. 0.175g/100mL photocatalyst was added to phenol solution to make reaction mixtures (60 ppm). For 1 hour, the mixture (phenol solution and nanoparticles) was stirred and left in the dark pending adsorption equilibrium was reached. The photoreactor was irradiated while being shaken continuously, and samples of the suspension stayed taken at regular intervals, centrifuged, and filtered. A UV-visible spectrophotometer was used to measure the phenol concentration in solution using a calibration curve of the absorbance at 270 nm, which is the maximum absorption of phenol. The results were adjusted to account for the phenol dye's breakdown in the absence of a photocatalyst.

To determine the phenol degradation efficiency, Eq. 1 was employed. η=[1−CC0[*100 (1)

where C 0 and C are the solution concentrations at t = 0 and t minutes under visible light, respectively.

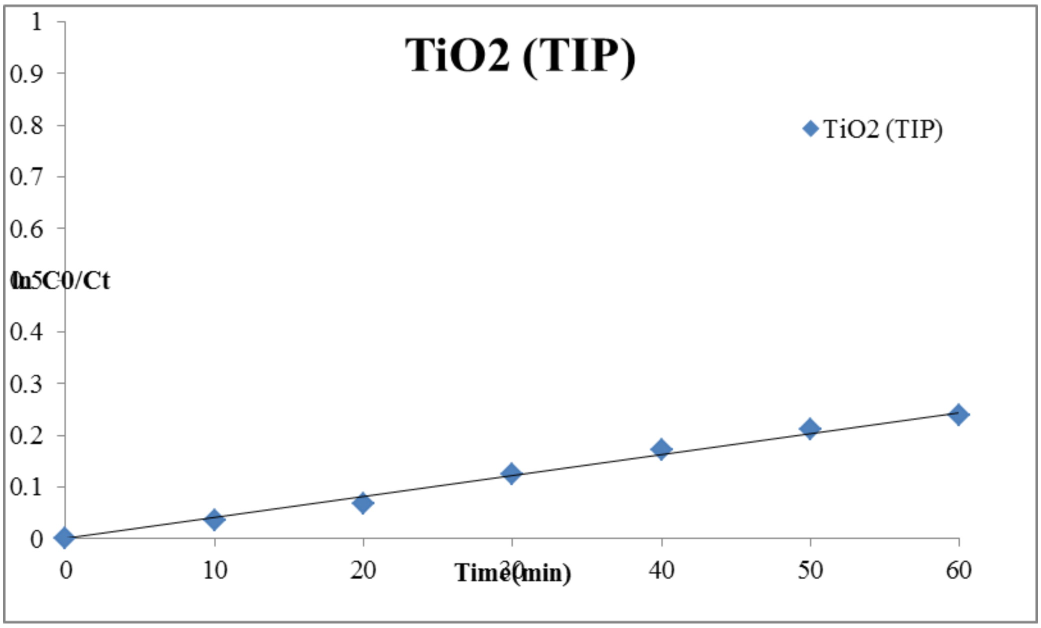


Figure 1

Changes of ln C_0/C_t according to irradiation times at TiO_2 and the prepared AC/TiO_2 composite

3. Results and discussion

3.1- XRD

X-ray diffraction is used to measure of graphitization. Figure 1 represented X-ray diffraction of TiO2.

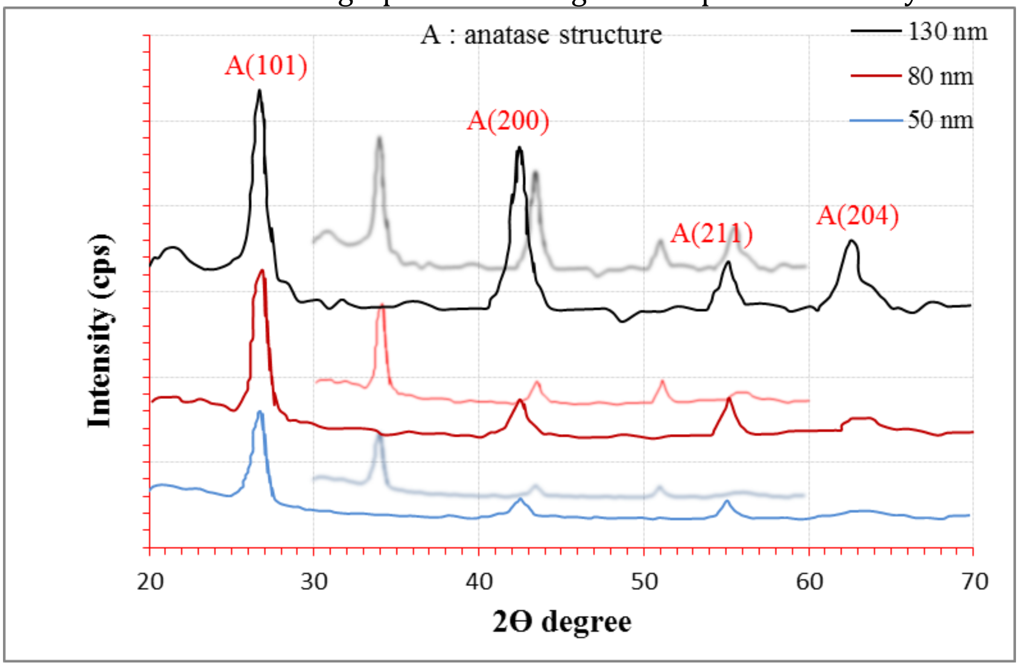
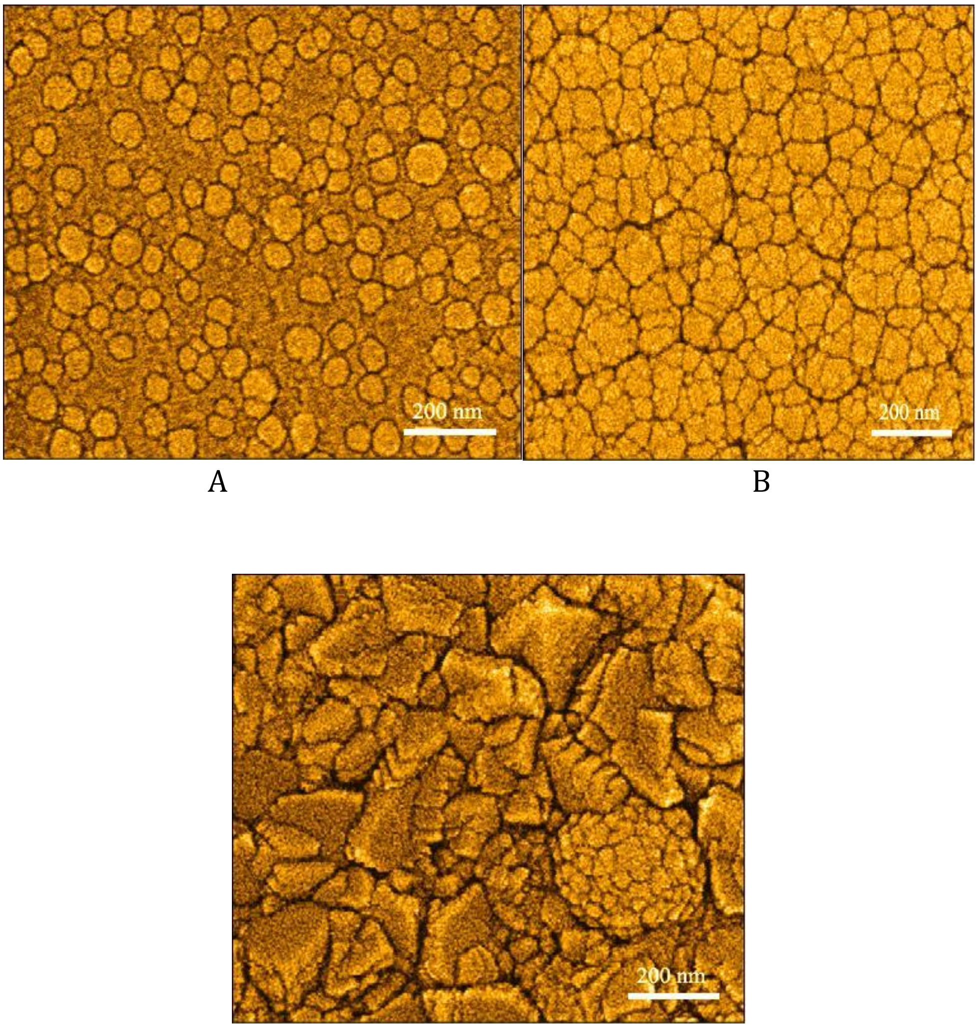


Figure 2: XRD of TiO2

3.2- SEM



A B

C

Fig-3 - SEM of TiO2 for different thickens of layer a.50nm,b.80 nm , c. 130 nm

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