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An Experimental Exploration on the Characterization of TiO_2 Using Sol-Gel

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Abstract
TiO_2 is defined as the photo catalyst and the poor adsorption so that the improvement of TiO_2 decomposition is performed for the purification of the organic pollutants in water and air. In this paper, the TiO_2 is defined and explored under the structure analysis. It also includes the deposition optimization using sol-gel approach. The works also include the relative experimentation for the purification process.
Keywords: TiO_2, Characterization, Sol-Gel, Optimization

I. Introduction

Oxidation process is one of the effective behavior approach to resolve the problem decomposition of industrial waste and the ground water. Titanium dioxide is one such material that is used in different industrial application to provide the assortment of products. The main products or the industries that comes under the Titanium Dioxide are the paint, white pigments, sunscreen lotions, food stuffs and the solar cell. The different forms of Titanium dioxide exist in four different forms shown in figure 1.

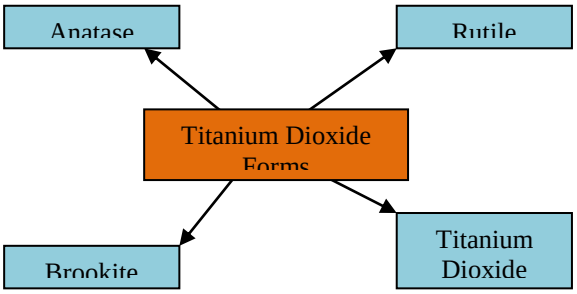
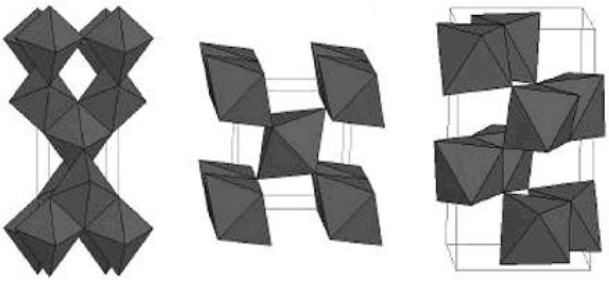


Figure 1 : Different Forms of Titanium Dioxide

The first form of Titanium Dioxide is Anatase that provides the crystalline structure formation under the tetragonal symmetry formation. Another form of TiO_2 that has the structural form as the tetragonal crystalline form called Rutile. This dioxide type is generally used in paints to add up the white pigments. Brookite is another type of TiO_2 having the orthorhombic crystalline structure. Titanium Dioxide is itself exist in the form of monoclinic mineral that is defined in the form of titanic family.



(A) (B) (C)

Figure 2 : Structural Representation of different forms of TiO_2 (A) Anatase (B) Rutile (C) Brookite

The water splition process on TiO_2 convert it to the single crystal form. This semiconductor photo catalyst is having its greater importance in the environmental purification process. Other than these, the analysis on the UV radiation is provided by the TiO_2. It also includes the degrading reaction approach so that the pollutant utilization of the system can be done. TiO_2 has defined a photo catalyst under the toxic refinement. TiO_2 is more advantageous because of its materialistic properties i.e. chemical stability, high natural abundance and the versatility to different applications.

A) Synthesis Process of TiO_2

Titanium Dioxide exist in the form of powder, crystals and the thin films. It includes the formation of films using crystallites from the nanometers and micrometers. It is also defined that the nano sized crystallites tend to agglomerate. The separation of the particles to form the deagglomerations. It also defined under the nanoparticles without the inclusion of

deagglomeration. Titanium Dioxide is defined with different chemical and physical characteristics so that the route preparation will be done. The route formation is defined using two main approaches called solution method and the gas-phase method. It also include the deposition under chemical vapor and the physical vapor.

B) Sol-gel Process

Sol-gel defines the solid product formation under the crystallization. Here the word, "sol" is about to achieve the stability in terms of colloidal particles or the polymer. It includes the particles that represent the amorphous. "gel" defines the porous under the solid network formation that gives the liquid phase. In "colloidal" gels, the network is made by agglomeration of dense colloidal particles. This process is represented by figure 3.

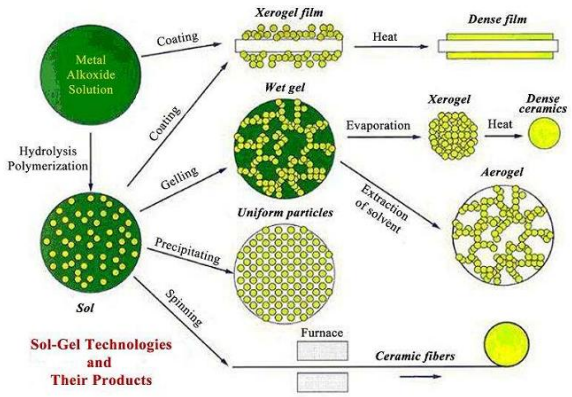


Figure 3 : Sol-gel Process

Figure 3 is showing the complete sol-gel process under the route optimization for the different materials. It is also defined under the spray drying of sol that is followed by Gel using the fibers that draw from the sol directly. Thin films are defined as the standard coating approach using the spraying. The gelation is defined as the fiber due to rapid evaporation of the solvents.

II. Literature Study

The work done by different researchers, on Titanium Dioxide analysis, its structural analysis and the exploration and optimization of its characters, is discussed in this section. In year 2012N. B. Ibrahim has defined an effect analysis and performance derivation approach for different TiO_2 preparation under different techniques. In this study, the preparation of TiO_2 thin film using sol-gel approach is presented and discussed. It also includes the electron gun based evaporation approach for the same analysis. Author has studied the microstructure analysis using field emission analysis and scanning identified by diffractometer. The study also analyzed the film effect analysis on the dielectric biometer. The study is performed under different measurement parameters such as sensitivity analysis, number of sensor repeatability etc. It also include the containment analysis on sol-gel on TiO_2 thin film that provide the optimization and annealing at high temperature[1]. Another work on the preparation of TiO_2 thin film was proposed byWeixin Huang in year 2011. The work includes the phase separation based stabilizer analysis approach so that the TiO_2 film will be produced under the circular pores and the surface. These pores are aroused from the solution so that the stability will be achieved. The work also include the interconnection analysis and the isolation so that the pores of the film are discussed in relation and the phase separation so that the sol-gel process with the existence of Acac and DEA. The work includes the time scaling of the sol-gel transition so that the composition preparation and selection will be done effectively[2]. Isrihetty Senain defined a work on the structural and electrical properties analysis on TiO_2 based thin film derivation was proposed using sol-gel method so the extensive study of the work will be done. In this paper, author defined the exploration of different starting meterials such as hydrochloric acid, ethanol, acetic acid, titanium butoxide and the deionized water etc. It includes the material mixture analysis under sol-gel approach. The analysis is done under the environmental vectors such as the heat and the aging treatment to attain the stability. The work also includes the layered approach anlaysis on titanium dioxide thin film so that the evaluation of the performance will be done under different surface based parameters so that the performance of the thin film will be improved. The work includes the determination of electrical property of thin film under the critical aspects so during the preparation process of TiO_2[3].

In Year 2010, Akbar Eshaghi has defined a property based analysis of nanocrystalline and photo induced based TiO_2 derivation under sol-gel approach. The work includes the deposition on the glass substrate so that the sol-gel based dip coating technique will be identified. The work includes the diffraction and Fourier transformation based behaviour analysis on thin film so that the optimization along with accurate assessment will be obtained. The work includes the super-hydrophilicity assessment under the contact angle measurement to evaluate the degradation of methylene so that the blue under UV irradiation will be performed. The work also includes the result derivation under the UV light irradiation so that significant effective will be derived with hydrophilic and photo catalytic properties of TiO_2 thin film[4]. Another work on the nanostructure formation for titanium dioxide thin film was defined under the solar cell analysis in year 2006 by T.Y.Wei. Author defined a nanostructured

titanium dioxide analysis under solar cell formation. The defined solar cell formation was sensitized under the structural analysis so that the nanopartical colloidal analysis will be performed and the conducting ability of the glass substrate will be identified. The high surface area of the thin film is the adhesion of the film that posses the controllable zie defined under 15 to 50 nm. The works include the mixture formation of alcohol and water so that good dispersion of solution will be attained [5]. In year 2006, Wang Shu-qin has defined a research on the treatment of wastewater by using nano-titanium dioxide. This treatment is defined under the conductance analysis as well as the adsorption analysis of dioxide characteristics under the photo-catalysis. The work includes the fluoride and sulphide removal efficiency analysis so that effective results will be drawn from the system [6]. Patrik Kania has defined a microscopic analysis of Titanium Monooxide and Titanium dioxide analysis. The work includes the transition analysis of titanium monoxide and titanium dioxide to detect the mean of laser ablation for the molecular beam analysis. The work includes the program under the rotational, leading distortion analysis for the fine structure determination [7].

Another work on the effect analysis of Silver and Titanium dioxide analysis was done under the efficiency analysis in year 2009. The work includes the interaction analysis under the nanomaterial analysis so that the biological system and role analysis will be done with biochemical analysis. In this work, the effect of silver nanoparticles and titanium dioxide nanoparticals is attained and evaluated under different vectors[8]. The work on the nanostructure analysis of TiO_2 for self regenerating humidity sensor is discussed by Daniel P. Smetaniuk. Author defined the layered sensing approach under the angle decomposition of fabricated titanium dioxide. Author defined the sensing layer based approach with regeneration of the sensor performance. The effect of ultraviolet wavelet is defined under the performance, aging and regeneration analysis. Author defined the regeneration of sensor for commercial applications of ultraviolet LEDs[9]. The effect analysis on doping under the structural and electrical derivation was defined for titanium dioxide. Author defined the doping process for the mixing cobalt source into TiO_2 sol gel [10].

III. Experimental analysis : A Study

TiO_2 is been synthesized using a titanium butoxide as a precursor using sol-gel approach at the low temperature conditions. The synthesis procedure and the characterization of products are defined. The synthesized process is performed under low temperature based environmental conditions. The characterization of TiO_2 is been defined under the purification process. In this process, ammonia solution is included to the TiO_2 upto the specific value of pH. It includes the synthesis process reaction under the exothermic and subjective to the high quantities of fumes. The white components are selected to be washed with double deionized for water under the chlorides that is removed completely from the test. Later on deionized water is included at the room temperature to the titanium oxide. The suspension process of this dioxide process is into two parts. Each part of the mixed so that the acid based ratio analysis on the amorphous titanium hydroxide in the aqueous solution. It includes the optimization under the molar ratio so that the photo catalyst will be obtained. It also include the crystalline generation at strong acid form and low temperatures. It includes the peptizing agents and condensation promoters. It includes the nitric acid and perchloric acid form.

The powder form was obtained from the collodial sol by the evaporation of the solvent at 50 C so that the drying of air. The powders were designated as the Ti-N and Ti-Cl where N and Cl. White powders are obtained from the type of amount of acid used. The white power containment is also analyzed under the inorganic residual so that the result optimization will be done. The experiments are performed at high pressure and high temperature, The weight consideration and other environmental parameters are also considered for the weight determination.

IV. Conclusion

In this paper, the study is been performed on the structure formation of Titanium Dioxide under different parameters. The optimization process is defined in this work using sol-gel approach. The experimentation based study is defined so that sol gels approach for the optimization of ZnO thin film.

V. ACKNOWLEGDGMENTS

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