PREPARATION OF CERIUM DOPED TITANIA NANO POWDER FOR PHOTOCATALYST

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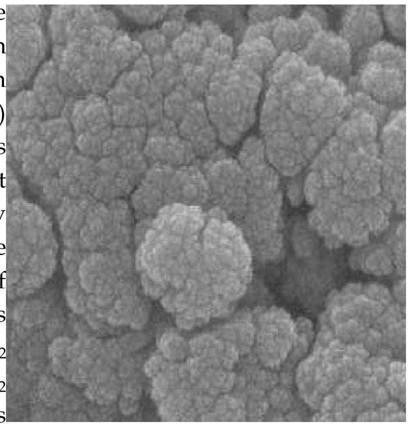
Abstract: Cerium doped anatase titania powders were prepared by sol-gel process, with ammonium (IV) nitrate and Titanium (IV) butoxide as the raw materials. The characteristics of anatase TiO_2 and cerium doped TiO_2 were investigated by XRD, DTA, FE-SEM and UV/Vis spectroscopy. Research results indicated that XRD data characteristic diffraction peaks of anatase phase and also showed that cerium phase was not observed. Moreover XRD and DTA results imply that the addition of cerium to titania modifies the mechanism of formation of the titania phases.

1. Introduction

It is well known that Titanium dioxide exists in three different polymorphs. These are brookite, anataseand rutile. Anatase and rutile are the more common forms. Both of them have a tetragonal crystal structure but different lattice parameters. Brookite on the other hand is a less common polymorph having an orthorhombic crystal structure. In all the three modifications titanium has a co-ordination number of six and exhibits octahedral symmetry. Though all the polymorphs of TiO_2 can be obtained in a stable form at ambient conditions, rutile remains the thermodynamically most stable form. Materials exhibiting activity upon visible light with surface characteristics of improved performance and of high chemical and physical stability is crucial for broader scale utilization of photocatalytic systems. In commercial application, such materials together with the development of technically applicable self aligning photocatalytic coating systems adaptable to major substrates (polymers, glass, ceramics and metals) will represent a ground breaking step change in this field particularly in the economic viability of a wide range of potential processes.

2. Results

A series of TiO_2 and $Ce_xTi_{(1-x)}O_2$ samples were prepared according to the following procedure: 1mole of TBT diluted with 25ml C_2H_5OH was added drop wise, vigorously stirring into 80ml distilled water. The solution was stirred for 45minutes at 70℃, andthen 3ml CH_3COOH was added drop wise. The resulting solution was continuously stirred for 1hour at 70℃. A clear sol was obtained and aged for 12hours at room temperature to obtain gel. The gel was dried at 70℃ for 5hours and then calcined at 550℃ for 2hours to obtain anatase TiO_2.Cerium doped titania was prepared similarly to pure titania: solution containing 1 mole of TBT, 25ml C_2H_5OH, and 80ml H_2O was prepared and solution containing 3ml CH_3COOH, 10ml C_2H_5OH, 10ml H_2O and Ammonium cerium (IV) nitrate, was added drop wise, vigorously stirring. The subsequent procedure was as mentioned above. The FE-SEM images of $TiO_2$and Ce-TiO_2 shown in figure(right show) illustrate that the addition of cerium leads to a change in the morphology and spherical clusters of agglomerates structures were observed. The particle size decreases with increasing cerium contents. This can be attributed to the presence of Ce-O-Ti. The optical absorption properties of pure TiO_2 and Ce-TiO_2 using UV/vis spectrophotometer, there is astrong absorption at 200nm upto 380nm for pure TiO_2 which can be attributed band gap excitation of anatase (3.2eV). Meanwhile, Ce-TiO_2 shift the absorption band toward the visible range (400nm–800nm). There appears to be an optimum content, where more cerium contents lead to decreased visible light absorption.



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