Poster

SIZE-MANIPULABLE SYNTHESIS AND STRUCTURAL CHARACTERIZATION OF TiO_2 NANOPARTICULES

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In the last decade, a great deal of effort has been devoted to develop materials with high photocatalytic activities for their wide environmental applications such as air purification, water disinfection,… Among the various oxides with photocatalytic activity, titanium dioxide has been proved to be one of the best photocatalysts due to its biological and chemical inertness, strong oxidizing power and long-term stability against photocorrosion and chemical corrosion for widespread environmental applications. However, the photocatalytic activity of titania must be further enhanced from the point of view of practical use. To achieve this purpose, the prepared rutile TiO_2 powders with good crystallization, small crystallite size and high specific surface area are prerequisite to enhance good photocatalytic activity. There are many methods available for the synthesis of nano-sized TiO_2 powder photocatalyst, such as, ultrasonic irradiation, UV light assistance, solvent evaporation-induced crystallization, sol-gel, hydrothermal etc… We have used for the synthesis of TiO_2 nanoparticules, the mechanical milling method, this technique provides a direct, simple, economical and free of solvents route to eventually obtain a ceramic of interest, with homogeneous particule size and highly pure product.

In this paper, we show the results obtained by mechanical milling method in the synthesis of TiO_2 nanoparticules with different size, the obtained materials were studied by high resolution electron microscopy and associated techniques.

The evolution of X-ray diffraction patterns for samples prepared using a rotating disc speed of 500 rpm, taken after 0, 24, 48, 72 and 96 hours of milling are shown in figure 1; a loss of crystallinity as a function of milling times can be observed. Figure 2corresponds to the HREM image obtained for the sample prepared for 96 hours. As it can be seen, the powder consists of agglomerates of homogeneous, crystalline particles with an average size clearly below 20 nm. Moreover, nanoparticules of 5 nm size were obtained as revealed by HREM (see the inset of figure 2). Reduction experiments are in progress is order to compare photocatalytic activity of both TiO_2 and oxygen deficient nanoparticles.

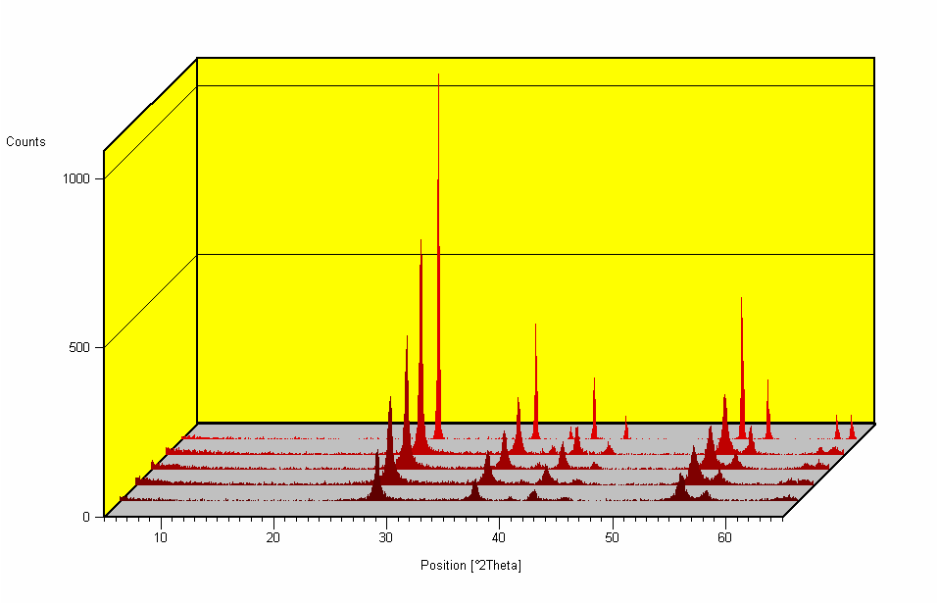

Figure **1.** Powder X-ray diffraction patterns evolution of TiO_2. Samples were taken after 0, 24, 48, 72 and 96 hours of milling.

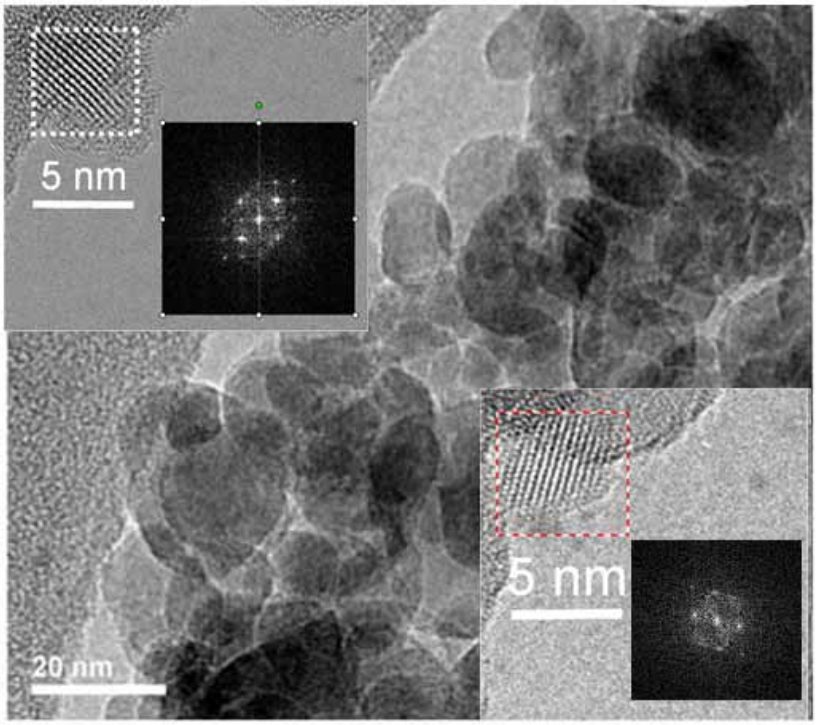

Figure **2**. HREM of a sample obtained after milling for 96 hours.

References:

1) *Wolfrum, E. J. - Huang, J. - Blake, D. M. - Maness, P.-C. - Huang, Z. - Fiest, J. - Jacoby, W. A.*, Environmental Science & Technology 36 (15): 3412-3419 (2002)