Synthesis and Characterization of Nd-Doped TiO_2 Photocatalysts

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The fact that TiO_2 is activated with the UV-light which constitutes only a very little part of the solar spectrum limits the use of this material in practical applications. Therefore, TiO_2's photoactivity must be developed for the practical applications. One way of increasing the photoactivity is to dope TiO_2 with transition metals or noble metals and to slide the absorption band from the UV area to the visible area.

Results in the literature have shown that doping TiO_2 with transition metal ions usually resulted in a hampered efficiency of the TiO_2 photocatalyst, though in some few cases, enhancements of the photocatalytic activity. Rare earth (La^{3+}, Ce^{3+}, Er^{3+}, Pr^{3+}, Gd^{3+}, Nd^{3+}, Sm^{3+})/TiO_2 photocatalysts performed better than the undoped TiO_2. In the light of this information Nd-doped TiO_2 photocatalysts were selected for synthesis and characterization as a subject for study.

Nd doped TiO_2 nanoparticles were synthesized by sol–gel method. . The catalysts were characterized structurally by X-ray diffraction (XRD), transmission electron microscopy (TEM), Brunauer, Emmet and Teller (BET) and Fourier Transform Infrared (FT-IR) techniques and X-ray Photoelectron Spectroscopy (XPS) techniques. Nd-doping concentration was selected 1 wt% and calcination temperature employed was 400 °C.

SEM–EDS analyses show that Nd element is unevenly distributed in Nd–TiO_2; XRD patterns reveal that the grain size of Nd–TiO_2 is smaller than that of pure-TiO_2 ; FTIR results indicate that Nd—O bond forms on Nd–TiO2 surface. XPS peaks showed four elements, namely, Ti, O, Nd and C, were present together on the TiO_2 surface.

Keywords: Sol-gel, TiO_2, Nd doping, TEM, XPS.

References

1) U.G. Akpan, B.H. Hameed, The advancements in sol–gel method of doped-TiO2 photocatalysts, Applied Catalysis A: General 375) 1–11 (2010
2) A. Bokare, M. Pai, A. A. Athawale, Surface modified Nd doped TiO_2 nanoparticles as photocatalysts in UV and solar light irradiation, Solar Energy 91 111–119 (2013).
3) H. Cuiying, Y. Wansheng, D. Liqin, L. Zhibin, S. Zhengang, Z. Lancui, Effect of Nd^{3+} Doping on Photocatalytic Activity of TiO_2 Nanoparticles for Water Decomposition to Hydrogen, Chin J Catal, 27 3 203–209 (2006).