Proceedings of the First Science Symposium – December, 2002
Faculty of Science, University of Ruhuna, Matara, Sri Lanka
50 -54

A correlation between activation energy and light absorption of WO_3 incorporated TiO_2

Dharmaratna[1*] W.G.D., Roshan[1] P.W.C., Siripala[2] W.P. and Wijesundera[2] L.B.D.R.P.
[1]Department of Physics, University of Ruhuna, Matara, Sri Lanka. [2]Department of Physics, University of Kelaniya, Kelaniya, Sri Lanka.
*corresponding author: *dharma@phy.ruh.ac.lk*

Abstract
The variation of electrical conductivity properties and light absorption properties are studied in W^{6+} incorporated TiO_2. Both conductivity and light absorption depend on the percentage of W^{6+} incorporated into the crystal matrix of TiO_2. The activation energy decreased by a maximum of 30% as a result of doping and the lowest activation energy was measured when the dopant concentration was 0.2%. The light reflectance decreased with the dopant percentage, but not in a monotonically decreasing passion. The variation of light reflectance as a function of dopant concentration showed a minimum when the dopant concentration was 0.2%. Both features are quite important in improving the photocatalytic properties of TiO_2.

Introduction
The modification of crystal structures of solids is becoming increasingly popular in many scientific and industrial applications. The incorporation of foreign atoms into the crystal structure of semiconductors is more attractive. In particular, the crystal structure of TiO_2has been modified with the incorporation of altervalent cations, which is of interest in applications such as pigments, paints, ceramics, solar energy and heterogeneous catalysis. The conversion of solar energy into chemical energy has attracted considerable research effort in recent years. The most widely investigated route is that of photochemical water cleavage in photoinduced systems. TiO_2 has been shown to be one of the most suitable materials to investigate as potential photocatalysts, because of its relatively favourable bandgap energy and high stability towards photocorrosion.

Photocatalytic performance of TiO_2 has been improved (Augustynski *et al.* 1977, Ghosh and Maruska 1977, Maruska and Ghosh 1979, Stadler and Augustynski 1979, Matsumoto *et al.* 1980, Borgarello *et al.* 1982, Kiwi and. Grãtzel 1986) by the incorporation of foreign atoms of higher valence, into the crystal structure. Furthermore, the light absorption and conversion capacity of TiO_2 has been extended from UV region to the visible portion of the solar spectrum due to the incorporation of foreign species. The increase of Fermi energy level of doped TiO_2, which alters the electronic interactions at the metal-semiconductor interface, believes to be the reason for these features. The increase of Fermi energy of the semiconductor implies higher electric field at the space charge region of the junction that favours the separation of the photo-produced electron-hole pairs and hence larger light conversion efficiency.

Alteration of Fermi energy level can be estimated by measuring the electrical conductivity of doped and undoped samples. It has been established (Akubuiro and Verykios 1989) that the specific electrical conductivity of TiO_2 doped with cations of higher valence is significantly higher than that of undoped TiO_2. The activation energy of