The Influence of Film Thickness on Photoactivity for TiO_2 Films Grown on Glass by CVD

Mark Nolan, David W Sheel and Martyn E Pemble

Institute for Materials Research, University of Salford, Salford, M5 4WT, UK

Tel/Fax +44 161 295 4800/5272

Titania is well known for its ability to act as a photocatalyst yet the relationship between microstructure and catalytic or photocatalytic activity has never been examined in detail. In this work we are preparing a range of novel TiO_2 films from a variety of chemical precursors using chemical vapour deposition (CVD). The CVD method has been selected because of its ability to impart a high degree of control of the structure, i.e. crystallinity and morphology and properties of the TiO_2 films by varying the growth conditions of flow rates, precursor concentrations and temperature. In particular we are seeking to explore the properties of nanoparticulate TiO_2 films grown directly by CVD.

We present XRD, SEM, FTIR and Optical thickness measurement data for the CVD growth of TiO_2 films using the precursor $Ti(OPri)_4$. Photoactivity appears to increase with increasing surface roughness, as may be expected from a purely surface-area argument. However the roughness also equates with both thickness and growth rate, in that for films of comparable thickness those deposited at the higher growth rates exhibit higher activity. In this respect for films that are optically thinner, photoactivity is seen to peak at a thickness of ca. 110-115 nm. Since XRD reveals that the films are predominantly anatase, we comment as to the efficiency of the CVD process for the production of photocatalytically active anatase

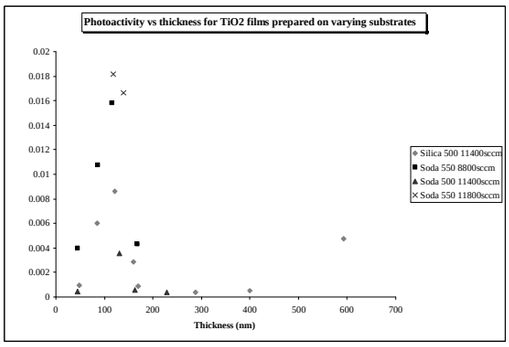

Figure 1

Figure 1 shows the photoactivity vs thickness for TiO_2 films prepared on silica coated and soda-lime substrates with varying flow rates.