Performance of nitrogen-doped TiO_2 films grown by MOCVD for water treatment under visible light

Eduardo César de Oliveira, Rodrigo Teixeira Bento, Olandir Vercino Correa, Marina Fuser Pillis

Titanium dioxide is a semiconductor employed as catalyst in the photodegradation of organic pollutants and bacteria. However, due to its large band gap TiO_2 only can be excited by UV light. Recently, TiO_2 doping with metals or nonmetals elements has been extensively exploited to allow its use under visible light. In the present work, nitrogen-doped and undoped TiO_2 films were grown on borosilicate substrates at 400 ° C for 60 minutes by metallorganic chemical vapor deposition (MOCVD). Titanium isopropoxide IV was used as precursor of titanium and oxygen, and ammonia as nitrogen source. Ammonia was incorporated into the films in three different quantities during the growth. The effect of nitrogen contents on the structural and surface properties of TiO_2 catalysts was evaluated. Both doped and undoped films presented rounded well-defined anatase grains. XPS analyses revealed that values of 1.6; 2.4 and 7.3 at% of nitrogen were incorporated into the films by varying the ammonia flux during the growth. Degradation assays have shown that nitrogen-doped TiO_2 films exhibited high photocatalytic activity under visible light irradiation. Undoped films did not present activity in this condition. The better catalytic performance under visible light, 55% of dye degradation, was attributed to the film containing 2.4 at% of nitrogen. The results suggest that nitrogen-doped TiO_2 catalysts grown by MOCVD have great potential to be used in the treatment of water under sunlight.