A comparative study of two techniques for determining photocatalytic activity of nitrogen doped TiO2 nanotubes under visible light irradiation: Photocatalytic reduction of dye and photocatalytic oxidation of organic molecules

Nitrogen-doping (N-doping) is a popular strategy for promoting the absorption of visible light in TiO2 and other photocatalysts. We have grown TiO2 nanotubes onto non-conducting Pyrex in a one step process via single layer titanium films. In an attempt to improve the self-cleaning ability of vertically aligned TiO2 nanotube arrays under visible light irradiation we have doped them with nitrogen and tested the resulting nanotube films by two representative test methods. The first method is an established dye-test which is typically used as a "quick-and-dirty" screening for activity. The second method is the gas-phase oxidation reaction of CO-oxidation and methane. The encouraging results of the dye tests are in conflict with the discouraging results of the gas-phase tests. The fact that the dye test gives a "false positive" underscores the dangers of extrapolating photocatalytic performance results from dye decoloration tests to more difficult redox reactions such as hydrocarbon mineralization.

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