

Doped titania photocatalytic thin films operating under visible light irradiation

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ABSTRACT

Over the recent years, considerable scientific efforts have been orientated towards improving the photocatalytic action of titanium dioxide. One of the main goals has become the activation of TiO₂ under visible light irradiation. To achieve this objective, several works have been conducted concerning the chemical modification of titania. This is attained by the introduction, “implantation” of various elements such as metal-ions e.g. transition metals: Cu, Ni, Cr, etc. as well as non-metal ions: N, S, C, etc. [1, 2]. In order to improve the photocatalytic activity under visible light, various doping techniques has been explored including precipitation, sol-gel, hydrolysis, sputtering and chemical vapor deposition (CVD) methods.

One of the most prevalent synthetic routes for the production of doped nanostructured titania has become the so called sol-gel process, widely known as hydrolysis-condensation (SOLUTION-GELation). In this study, titania thin films were prepared by sol-gel method using titanium butoxide (TBOT) or titanium isopropoxide (TIP) and distilled water/ HNO₃ as titanium precursor and hydrolyzing agent, respectively. Two different dopants (urea or thiourea) were used in order to enhance the efficiency of TiO₂ under visible irradiation. The produced sol-gel was deposited onto glass and ceramic surfaces via spray pyrolysis technique.

X-ray diffraction patterns (XRD) of the photocatalytic thin films were obtained in the diffraction angle range $2\theta = 20^\circ$ - 80° using Cu K α radiation. FT-Infrared spectra were obtained in range of 700 to 5000 cm⁻¹ by using the ATR method. Micro-Raman measurements were carried out as well as diffuse reflectance UV-Vis spectra from 200nm to 700nm. Moreover, morphology and particle size were studied by using scanning electron microscopy technique (SEM). The size and the zeta potential were determined by using a nano Z-sizer apparatus. Moreover antimicrobial properties of the produced thin films were studied.

References

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