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V doped-TiO2 anatase thin films deposited by Plasma Enhanced Chemical Vapour Deposition at low substrate temperature for photocatalytic applications

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Anatase TiO_2 thin films are of major interest due to their valuable properties. However, anatase band gap (3.2 eV) limits the photocatalytic reaction under visible light irradiation. Thus, one of nowadays' burning topic in photocatalysts is the redshift of photocatalytic reaction. Among various approaches, transition metal doped TiO_2 layers appears to be a very promising one.
In this work, we investigate the possibility of synthetizing V doped anatase TiO_2 layer by a low-substrate temperature pulsed Electron Cyclotron Wave Resonance (ECWR) PECVD process, using Vanadyl (V) triisopropoxide (VTOP) and Titanium (IV) isopropoxide (TTIP) as precursors. The influence of several experimental parameters such as the RF power, the pressure, and the plasma gas mixture are explored. We mainly focus on the V doping concentration, which can be tuned by varying the TTIP/VTOP ratio injected in the plasma. The cristallinity, morphology and composition of these V-doped titania layers are characterized by means of Scanning Electron Microscopy, Raman Spectroscopy, X-Ray Diffraction analysis. V position in the TiO_2 lattice is also monitored by XRD and Raman. UV/Visible absorption spectroscopy and ellipsometry were used in order to monitor the impact of the dopant concentration on the optical properties, i.e. their band gap, to evaluate their ability to absorb visible light. Finally, the photocatalytic performances of the V-TiO_2 layers are evaluated by measuring their ability to decompose stearic acid under 365 nm UV-light and solar spectrum simulator.

Keywords
Pulsed-PECVD
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