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PII: S0926-3373(18)30042-0
DOI: https://doi.org/10.1016/j.apcatb.2018.01.035
Reference: APCATB 16351

To appear in: *Applied Catalysis B: Environmental*

Received date: 1-12-2017
Revised date: 12-1-2018
Accepted date: 15-1-2018

Please cite this article as: Radek Zouzelka, Monika Remzova, Libor Brabec, Jiri Rathousky, Photocatalytic Performance of Porous TiO2 Layers Prepared by Quantitative Electrophoretic Deposition from Organic Solvents, Applied Catalysis B, Environmental https://doi.org/10.1016/j.apcatb.2018.01.035

Photocatalytic Performance of Porous TiO_2 Layers Prepared by Quantitative Electrophoretic Deposition from Organic Solvents

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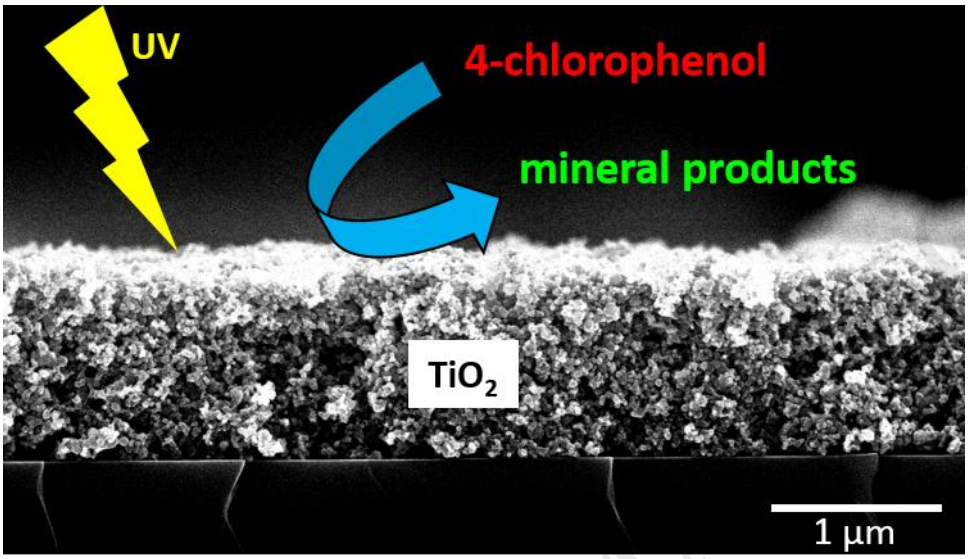
Graphical abstract



Highlights

- Quantitative electrophoretic deposition of titania particles without any additives.
- High efficacy of layers in the photocatalytic degradation of 4-chlorophenol.
- Almost 100% mineralization of 4-chlorophenol on the most active layers.
- Mechanism of the photocatalytic degradation depends on the structure of titania.

ABSTRACT

Highly-crystalline TiO_2 nanoparticles coated on a suitable substrate make excellent photocatalysts for environmental applications. While electrophoretic deposition is frequently used to prepare such layers on a conductive support, this method often requires the presence of an additive to suppress nanoparticle agglomeration and increase particle surface charge. However, the presence of an additive can lead to contamination that negatively affects layer properties. To overcome this drawback, we developed an optimized electrophoretic method for the preparation of porous TiO_2 layers, whose photocatalytic performance in the degradation of a toxic compound was analyzed. Our method enabled TiO_2 layers (anatase, rutile and their mixture) to be quantitatively deposited on rigid substrates (stainless steel, FTO-glass and silicon wafers) without sintering and without the use of a dispersive additive. The photocatalytic