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Photocatalytic Anatase TiO_2 Thin Films Deposited on Temperature-Sensitive Substrates by Atmospheric-Pressure Low-Temperature Plasma – Application to water purification

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Titanium dioxide (TiO_2), one of the most important photocatalytic materials, has met a wide range of applications, including environmental purification, water splitting and self-cleaning surfaces. Numerous methods have already been investigated for the formation and deposition of anatase TiO_2 thin films[1-3]. Due to their undeniable industrial advantages, such as low temperature, low cost, easy implementation and in-line process capabilities, low-temperature atmospheric-pressure plasma processes have become the most promising 'next generation' candidate system for replacing low-pressure plasma or wet chemical processes for the deposition of functional coatings.
In this work, anatase TiO_2 thin films were deposited at atmospheric-pressure on polymer and silicon substrates using a microwave plasma discharge. The careful selection of the titanium precursor allows to the deposition of well adherent, dense and crystalline TiO_2 coatings, such as revealed by SEM and XRD/Raman spectroscopy, respectively. The photocatalytic activity of the TiO_2 thin films under UV light was demonstrated by monitoring the degradation of methylene blue and sulfamethoxazole (a common antibiotic) by UV-Vis spectrophotometry. The oxygen content in the plasma gas discharge did allow to the growth of larger anatase crystals and to the increase of the photocatalytic activity. The significance of this photocatalytic approach for the removal of antibiotics is also investigated, in particular its potential cytotoxicity.

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Keywords
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