Synthesis of Bi_2O_3:TiO_2 nano structured thin films for photocatalytic applications

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The increasing scarcity of potable water has served as motivation for the development of decontamination processes. Photocatalytic degradation is one of the most viable processes compared with conventional ones. This process uses the UV radiation effect to produce hydroxyl radicals, with the assistance of a photocatalyst. The most commonly used catalyst is TiO_2 semiconductor, characterized by its low toxicity and high chemical stability. This work aims to synthesize Bi_2O_3 thin films with fibrous morphology for subsequent functionalization with a top TiO_2 thin film. A Hastelloy B3 thin film was used as an interface layer between the glass substrate and the Bi seed layer in order to promote some interfacial roughness and improve film adhesion. The growth of Bi_2O_3 thin films was performed by magnetron sputtering and adapted to abide the vapor-liquid-solid (VLS) mechanism, mainly concerning its 3D growth morphology and its high roughness templates. Subsequently, the TiO_2 photocatalytic thin films were deposited onto the Bi_2O_3 thin films. SEM observations revealed a pine-tree morphology for the Bi_2O_3 nano structures, with an enhanced surface area. The photocatalytic efficiency assessment was performed by conducting an assay using methylene blue dye as the pollutant and a solar radiation simulator. The tests show that the thin films of Bi_2O_3:TiO_2 are more efficient at degrading the pollutant when compared with the TiO_2 thin films.

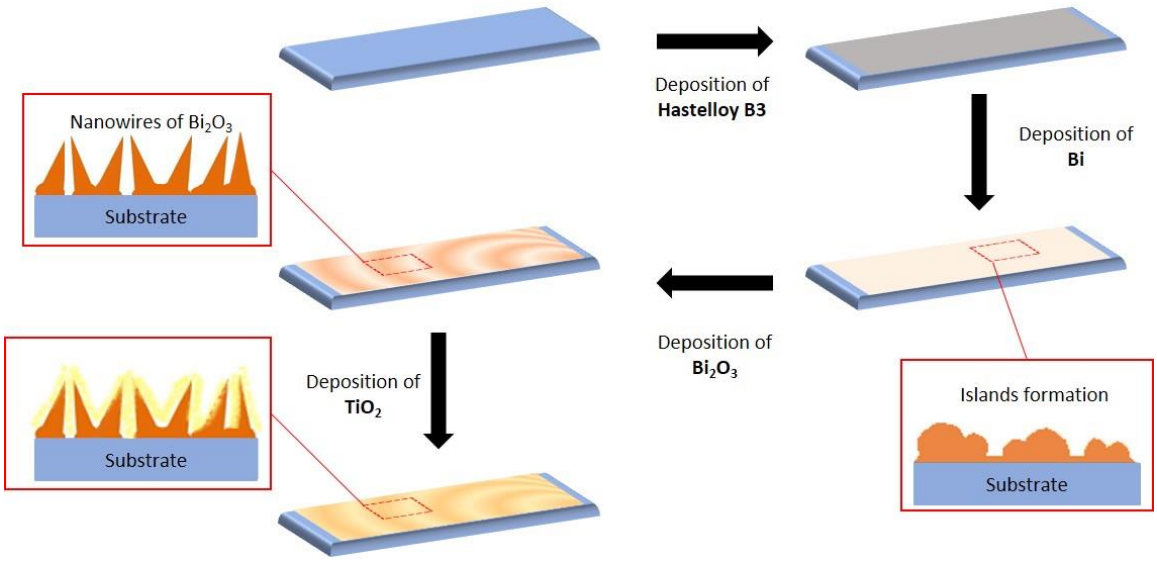

Figure 1 - Scheme with the different stages of the multilayered hastelloy/Bi/Bi2O3/TiO2 film growth.

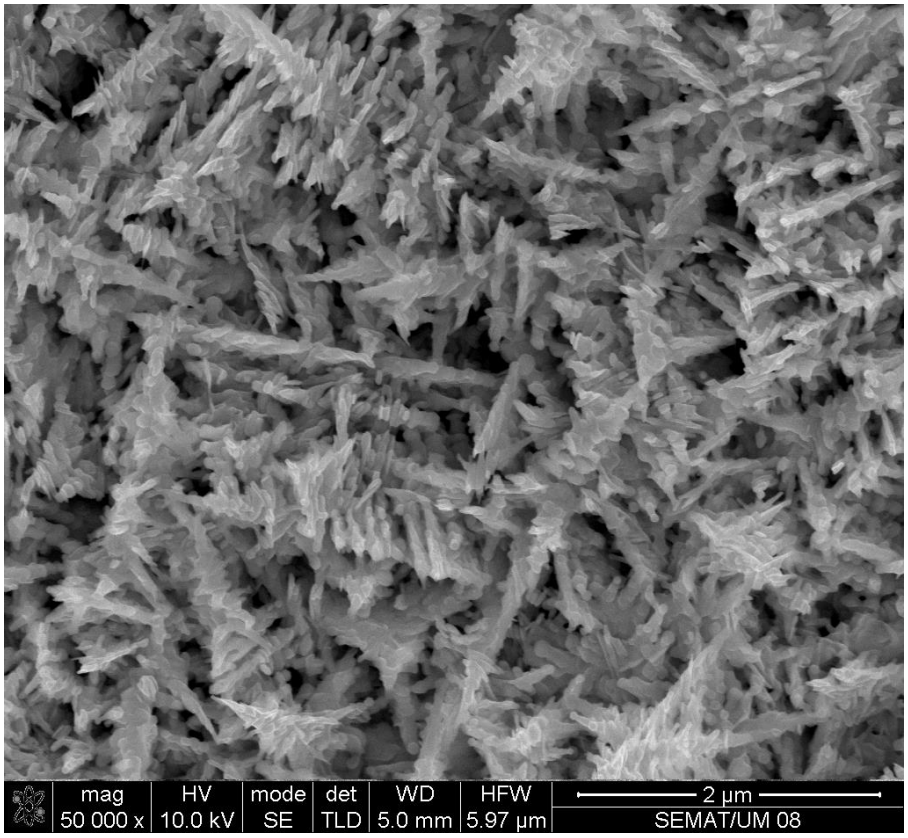

Figure 2 – Pine-tree morphology of the VLS grown Bi_2O_3 nanostructures.