PREPARATION OF PHOTOCATALYSTS BY ATOMIC LAYER DEPOSITION

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Abstract
The use of semiconductor-based photocatalysts (e.g. metal oxides) in sewage water treatment is expected to be of great interest despite its shortcomings [1]. High surface area organic semiconductor-based structures are promising alternatives for the photodegradation of various organic pollutants. In addition, these polymer structures could be great backbones to produce polymer/metal oxide composite photocatalysts by Atomic Layer Deposition (ALD).

Introduction
Organic-based semiconductors, such as conjugated polymers are very appealing alternatives of the traditional metal-oxide-based photocatalysts, with easier recovery and visible light excitability. Forming these polymers in a PolyHIPE (High Internal Phase Emulsion) structure is a great way to produce high surface area photochemically active backbones with great mechanical stability [2].
The atomic layer deposition is a novel thin layer or nanoparticle synthesis method which is based on the reaction of the gas-phased precursors adsorbed on the surface of the substrate. By changing the number of the cycles, the thickness of the layer or the size of the nanoparticle is finely tunable. With this method, it is possible to deposit metals, metal oxides, selenides, sulfides etc [3].

Experimental
The composites were synthesized by atomic layer deposition, depositing titanium dioxide and zinc oxide layers on the conjugated polymer support with different cycle number. The Beneq TFS 200 ALD equipment was used during the process. The as-synthetized composites were characterized by Scanning electron microscopy (SEM), thermogravimetric analysis (TGA) and X-ray diffraction (XRD).

Results and discussion
On figure 1 (a) we can see the thermogravimetric curve of the 300 cycle TiO_2, where the amount of titanate was 12,13%.

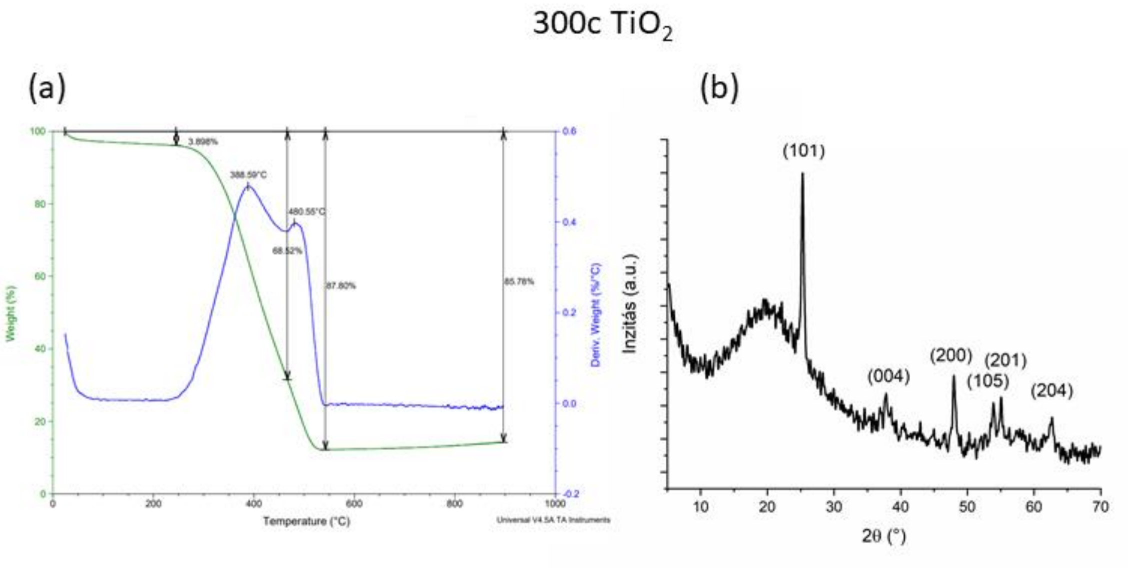

Figure 1. The thermogravimetric curve (a) and the X-ray diffractogram (b) of the 300 cycle ALD synthetized catalyst.

On figure 1. (b) we can see the X-ray diffractogram of the 300 cycle composite catalyst. The reflexions of the (101), (004), (200), (105), (201), (204) Miller index planes of the anatase are clearly visible, which indicates that crystalline anatase formed on the surface of the polymer backbone.

Conclusion

We successfully synthetized TiO_2/polymer and ZnO/polymer composite photocatalysts and found the ideal cycle number to prepare our samples with the desired amount of oxide. The as-synthetized catalysts were characterized by SEM, TGA and XRD.

Acknowledgements

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References

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