Regeneration performance of the nanostructured titania photocatalyst prepared by anodic growth

Mandic, V.[1], Panzic, I.[2], Plodinec, M.[2] and Brnardić, I.[3]

[1] Faculty of Chemical Engineering and Technology, Croatia, [2] RBI, Croatia, [3] MF, Croatia

Previously we observed the possibility to modify the titania nanotube anodization process to yield highly effective photocatalysts with reduced level of order, i.e. increased microstructural inhomogeneity at horizontal level and chemical inhomogeneity at vertical scale. Basically the defects induced on behalf of such modification favour high photocatalytic activity. Here we investigate the durability and reusability of the as-prepared photocatalyst samples. The photodegradation of acetylsalicylic acid was repeated several times using the same selected samples. Results were modelled and photocatalyst lifetime was discussed. Vibration spectroscopies and depth sensitive diffraction techniques were used to monitor the samples before and after the extensive use in order to evaluate the contribution of the as-formed different areas in the final photocatalytic efficiency. Samples retain photocatalytic properties for reasonably long time. Here we test a novel concept of photocatalyst regeneration where the used samples were electrochemically re-synthesized in order to enable new activation in degradation efficiency. The reactivated photocatalyst was subjected to degradation tests to show remarkable photocatalytic activity regeneration. For the first time the cross-section HR electron microscopy of cycled and then regenerated samples offered the insight in the complex microstructural and chemical evolution on behalf of photodegradation and anodic re-growth. This novel concept may be considered as ground-breaking in terms of facile, cheap and environmental photocatalytic micro-pollutants removal.

The financial support of the Croatian Microscopy Society and CSF project No 9419 are gratefully acknowledged.