**S. Franz, D. Perego, O. Marchese, M. Bestetti**

# PHOTOELECTROCHEMICAL ADVANCED OXIDATION PROCESSES ON NANOSTRUCTURED $TiO_2$ CATALYSTS: DECOLORIZATION OF A TEXTILE AZO-DYE

Department of Chemistry, Materials and Chemical Engineering "G. Natta" – Politecnico di Milano, Italy
silvia.franz@polimi.it

*This work describes a novel approach for water treatment by photoelectrocatalysis, based on nanostructured $TiO_2$. The decolorization of aqueous solutions containing the azo-dye RR243 is carried out in a tubular photocatalytic reactor working in semi-batch mode under electrical polarization of the catalyst. Two different nanostructured catalysts were tested: nanotubular $TiO_2$ obtained by conventional anodization (CA), and a novel photoactive nanoporous $TiO_2$ obtained by plasma electrolytic oxidation (PEO). Neither UV irradiation of the $TiO_2$ catalysts nor the electrical bias individually considered lead to a significant reduction of the dye concentration. By irradiating the catalysts with UVC light while applying an electrical bias to the same, the concentration of the dye decreased from 25 L to 2,5 mg/L using the nanotubular CA $TiO_2$ catalyst, and to less than 1,8 mg/L using the novel nanoporous PEO $TiO_2$ in 50 min. The main advantages of this method over current approaches for the degradation of pollutants are both the considerable processing time reduction and a suitable and easy-to-scale-up reactor design. A further advantage is the relatively easyness in the production of the $TiO_2$ catalysts by PEO.*

**Keywords:** anodization, decolorization, advanced oxidation processes, photoelectrochemistry, titanium dioxide, water treatment

## Introduction

In compliance with the strict regulations on water quality, in recent years the processes for water and wastewater treatments were mostly conceived to address the removal of refractory organic compounds, such as dyes, solvents or pesticides. Chemical oxidation treatments involving transient radical species,

respectet to data reported in literature, making the electrophotocatalytic water treatment more competitive with stablished advanced oxidation processes. The production of $TiO_2$ catalysis by low temperature plasma electrolytic oxidation did not need annealing treatments nor long processing times, as in the case of conventional anodization, leading to significant advantages.


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