Photocatalytic Ability of Cotton Pads Modified with TiO_2-Pt/Reduced Graphene Oxide and SiO_2-Pt/Reduced Graphene Oxide Composites

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INTRODUCTION

Nowadays, high quality fabrics having self-cleaning, antimicrobial, UV blocking and comfort characteristics can be developed by modifying textile materials with different nanomaterials.

MOTIVATION

Textile materials with photocatalytic characteristics were obtained by modifying cotton pads surface with TiO_2-Pt/reduced graphene oxide (TiO_2-Pt/GR) and SiO_2-Pt/reduced graphene oxide (SiO_2-Pt/GR) composites.

EXPERIMENTAL

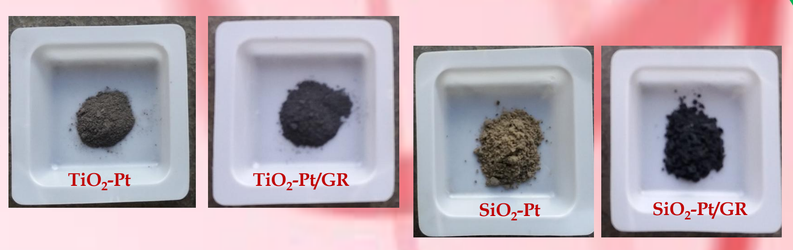
Preparation of TiO_2-Pt/GR and SiO_2-Pt/GR composites

Graphene oxide (GO) was obtained from graphite by a chemical oxidation process (a modified Hummer's method). TiO_2-Pt and SiO_2-Pt (with 2% Pt/Ti, respectively 2% Pt/Si molar ratios) were synthesized by chemical reduction of hexachloroplatinic acid (H_2PtCl_6) solution with ascorbic acid at 80°C.

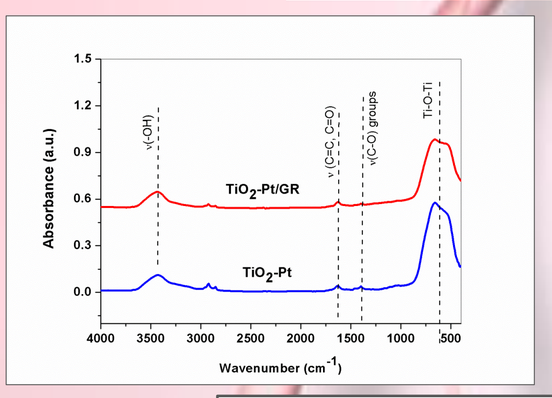
TiO_2-Pt/GR and SiO_2-Pt/GR composites were prepared by thermal treatment of TiO_2-Pt/GO and SiO_2-Pt/GO (with 10:1 initial mass ratio of TiO_2-Pt, respectively SiO_2-Pt to the GO) at 300°C, for 15 minutes, under argon atmosphere.

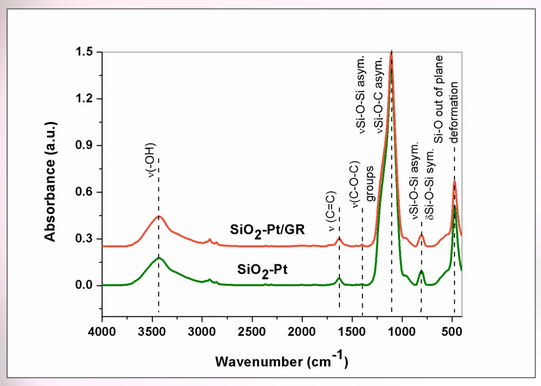
Preparation of composites-coated cotton pads

Cotton pads (d = 6 cm) were immersed into the dispersion of obtained composites (1 mg/ml ethanol solution 10%) for 5 minutes and then, the textile materials were dried at room temperature.

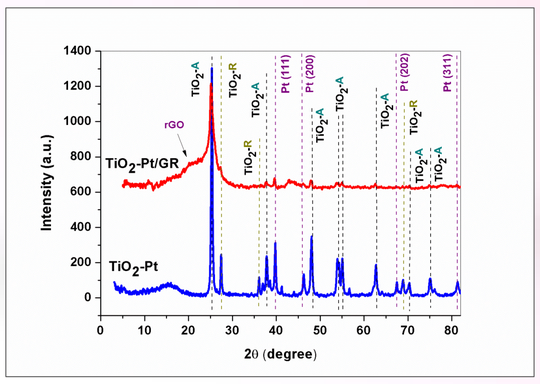


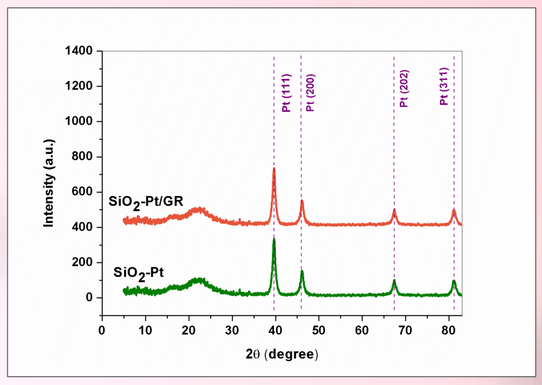
STRUCTURAL AND MORPHOLOGICAL CHARACTERIZATION OF COMPOSITES



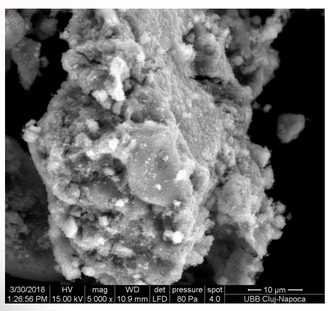


Infrared Spectroscopy (FTIR) analysis

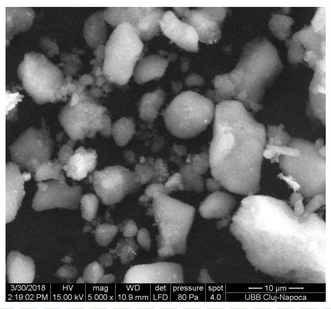




X-ray powder Diffraction (XRD) investigation



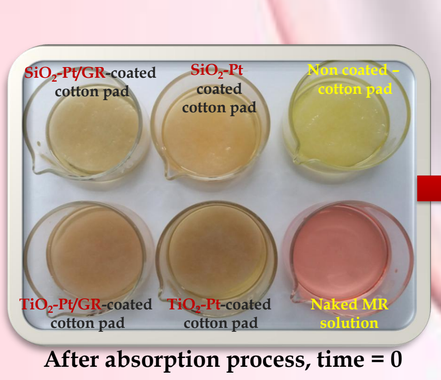
SEM image of TiO_2-Pt/GR composite



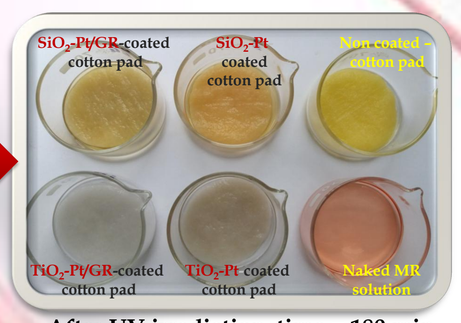
SEM image of SiO_2-Pt/GR composite

PHOTOCATALYTIC ACTIVITY OF COMPOSITES-COATED COTTON PADS ON METHYL RED DEGRADATION

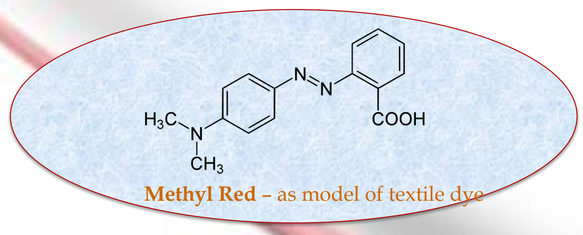
The photocatalytic activity of treated textiles was evaluated by degradation of $2x10^{-5}$M methyl red (MR) aqueous solution under ultraviolet (UV) light irradiation using a homemade system equipped with a lamp OSRAM VITALUX 300W.



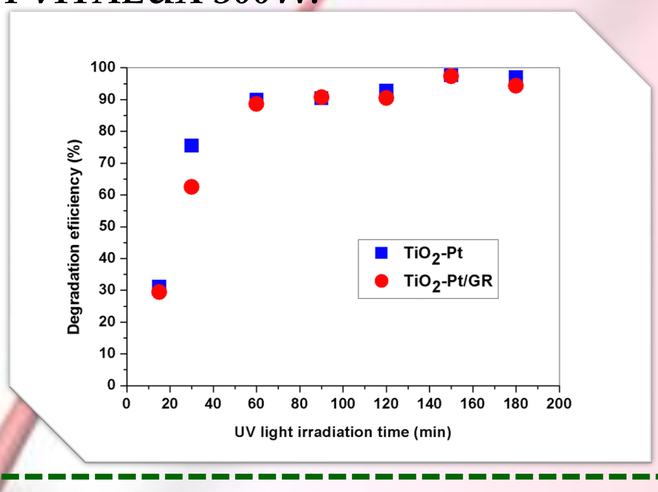
After absorption process, time = 0



After UV irradiation, time = 180 min.



Methyl Red – as model of textile dye



The methyl red degradation experiments in the absence of composites can be considered as negligible. SiO_2-based composites not display noticeable photocatalytic activity, thus its behavior in methyl red photodegradation has not been presented. The photodegradation efficiency of the TiO_2-Pt/GR-coated cotton pads was clearly superior to that of similar textiles containing SiO_2-based materials. It is expected that TiO_2/graphene-based nanocomposites might be used to introduce high performance characteristics of various textile products.

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