DESIGN OF VISIBLE LIGHT ACTIVE PHOTOCATALYTIC NANOMATERIALS: FROM LAB TO REAL ENVIRONMENTAL APPLICATIONS

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ABSTRACT

Air quality is an important determinant of human health, comfort and productivity. Indoor air pollutants are often 2 to 5 times higher than outdoor levels, and in some cases these levels can exceed 100 times that of outdoor levels of the same pollutants. In other words, sometimes the air inside can be more harmful than the air outside[1]. Indicative air cleaning technologies which have been developed during the recent years are: filtration and adsorption, electrostatic air purification, air filtration and gas adsorption filtration, ozonation, non-thermal plasma and photocatalytic oxidation (PCO). PCO is a general air cleaning technology, which is able to degrade Volatile Organic Compounds (VOCs), such as aromatics, alkanes, odor compounds etc. Air cleaning photocatalytic technology is based on the principle that radiation of suitable wavelengths can be absorbed by semiconductors, which leads to the creation of reactive oxygen species (ROS) that can degrade air pollutants. TiO_2 is the most commonly-used semiconductor in PCO research[2].

In the present work, visible light active photocatalytic nanomaterials based on titanium dioxide doped with transition metals, were prepared via a modified sol gel procedure. The synthetic procedure is simple, quick, inexpensive, and allows for large-scale material production and application[1].

Mn doped titanium dioxide shows the best photocatalytic activity under visible light, and used to prepare photocatalytic paints [3,4,5]. This photocatalytic paint applied on the surface of 1m x 1m panels (up-scale coatings) such as gypsum board, for the performance of real-time measurements in the Demo-Houses. The interior area of the Demo-House where the up-scale panels will be applied is $9m^2$ (ceiling and walls), and approximately 1,5 Kg of photo-paint will be used.

KEYWORDS: photocatalytic nanomaterials, Mn doped titanium dioxide, air quality, paints, demo houses

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