

# 使用纳米二氧化钛建筑材料的光催化作用对有毒污染物进行补救：综述

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**摘要:** 纳米二氧化钛, 由于其独特的光催化和疏水特性, 可用于制备自清洁的水泥基智能建筑材料。正二氧化钛通过其光催化作用降解有机和无机污染物, 并将其转化为无毒的副产品, 即改善空气质量。在这篇综述中, 概述了纳米二氧化钛的合成方法、纳米二氧化钛在水泥基材料上的负载方法、光催化性能、自清洁机制以及纳米二氧化钛在水泥基材料中的应用等方面。此外, 二氧化钛可作为涂料或添加剂用于路面砖、斑马线的砂浆/混凝土、道路隔离带和衬里以及高层建筑。此外, 在水泥基材料中使用纳米二氧化钛的影响和经济方面显示, 与传统建筑材料相比, 纳米二氧化钛的材料成本增加了约 27%, (101 至 128.1 美元)。此外, 低成本的碳化材料, 如生物炭, 被建议用作纳米二氧化钛的载体, 以降低成本并提高光催化混凝土的修复效率。

**关键词:** 纳米二氧化钛; 智能建筑材料; 自清洁; 污染物修复

## Remediation of Noxious Pollutants using Nano-titania-based Photocatalytic Construction Materials: A Review

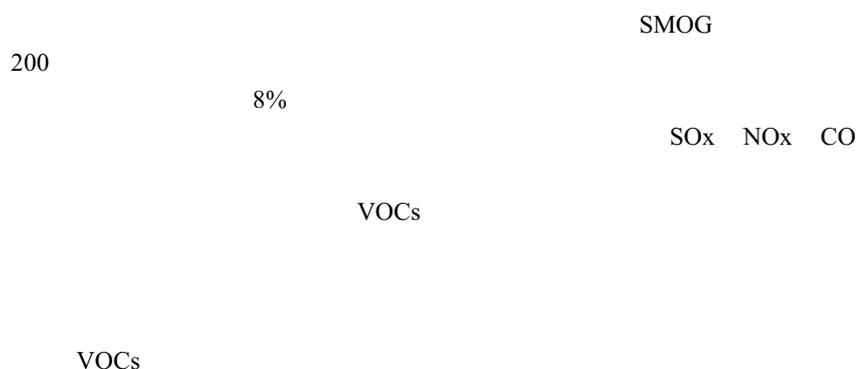
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**Abstract** Nano-titania (n-TiO<sub>2</sub>), due to its unique photocatalytic and hydrophobic properties, can be used to prepare self-cleaning cementbased smart building materials. The n-TiO<sub>2</sub> degrades organic and inorganic pollutants through its photocatalytic action and convert them into non-toxic by-products, i.e., improves the air quality. In this review, aspects such as methodologies of n-TiO<sub>2</sub> synthesis, approaches for n-TiO<sub>2</sub> loading on cementitious materials, photocatalytic properties, self-cleaning mechanism, and application of n-TiO<sub>2</sub> in cement-based materials have been overviewed. Further, the n-TiO<sub>2</sub> can be used either as coatings or admixtures in pavement blocks, mortars/concrete at zebra crossings, road dividers and linings, and high-rise buildings. Moreover, the implications and economic aspects of n-TiO<sub>2</sub> usage in cement-based materials revealed that n-TiO<sub>2</sub> increases the material cost by ~ 27%, (101 to 128.1\$) in comparison to conventional building materials. Furthermore, the low-cost carbonized materials such as biochars have been suggested to be used as support of n-TiO<sub>2</sub> to lower the cost and improve the remediation efficiency of photocatalytic concrete.

**Keywords** Nano-titania; Smart building material; Self-cleaning; Pollutant remediation

### 一、引言



SiO<sub>2</sub> ZnO<sub>2</sub> Al<sub>2</sub>O<sub>3</sub> TiO<sub>2</sub> CNTs

TOTO / h<sup>+</sup> e<sup>-</sup>  
OH<sup>-</sup> VB CB  
O<sub>2</sub><sup>-</sup>

#### 四、将纳米二氧化钛掺入水泥基材料的方法

#### 二、纳米材料和水泥复合材料

#### 五、与胶凝材料混合

Jubilee / i  
ii  
Graziani  
/ Lackhoff  
Chen Poon  
TiO<sub>2</sub><sup>-</sup>  
Fe<sub>2</sub>O<sub>3</sub>  
Fe<sub>2</sub>O<sub>3</sub>  
Al<sub>2</sub>O<sub>3</sub> / CNTs/CNFs

TPa GPa  
CNFs

#### 三、纳米钛合金

#### 六、混凝土的表面涂层

5

503 354 m2

/g 15% -85%brookite 53% -  
47%brookite  
TiO28 h TiO216 h

5%  
100%

Maury-ramirez

### 八、催化剂负载的影响

86%

Chen

### 九、温度的影响

8

5

95%

NO

HO-

89%

NO

PURETI 99%

1%

O2

40

PURETI

TiO2

H2O

OH-

0 12 24 36

### 十、纳米二氧化钛的工业应用和毒性

Li

NO

TiO2

### 七、工艺参数对光催化的影响

Erdem

16.2 45.8

96

/ 401 /

Lin  
LC50

Dell'Edera

