The Use of Nano-Titanium Dioxide for Photocatalysis Applications and Photovoltaics for Energy Production

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Brilliance inspired by titanium

Photocatalytic Technology

Offers a Range of Functionalities and Environmental Solutions

A properly designed photocatalytic surface can

1. **Reverses Pollution (NOx and VOC)**– functionalising roads, bridges and buildings to reduce pollution
2. **Reduces Heat Island Effect** – by keeping roofs and building white longer
3. **Low maintenance / Self cleaning** – Buildings and Photovoltaic cells

Nano TiO2 can be used as a critical component of PV cells

4. **Used as a critical component for 3rd Generation Photovoltaics**

Case Study - Camden Borough, London

Monitoring the performance

Transparent sol applied
March 2009

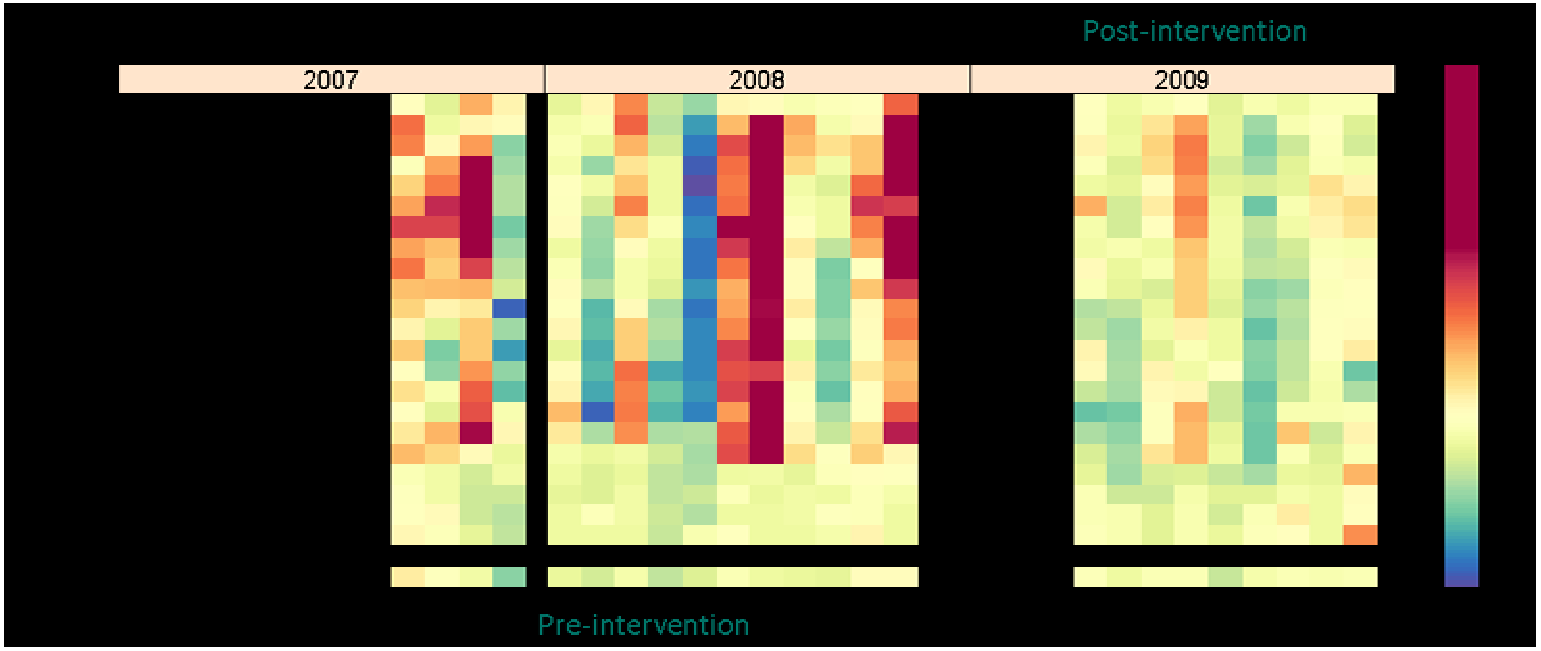
Monitoring station:

- **NO,NO_2,NOx**
- **Wind speed**
- **Wind direction**
- **Temperature**
- **Humidity**

- Measurements of NO, NO_2, NOx taken every 15 minutes (began in 2007)
- Data collected and analysed in collaboration with ERG (Kings College)

Monthly & Diurnal NOX Variation

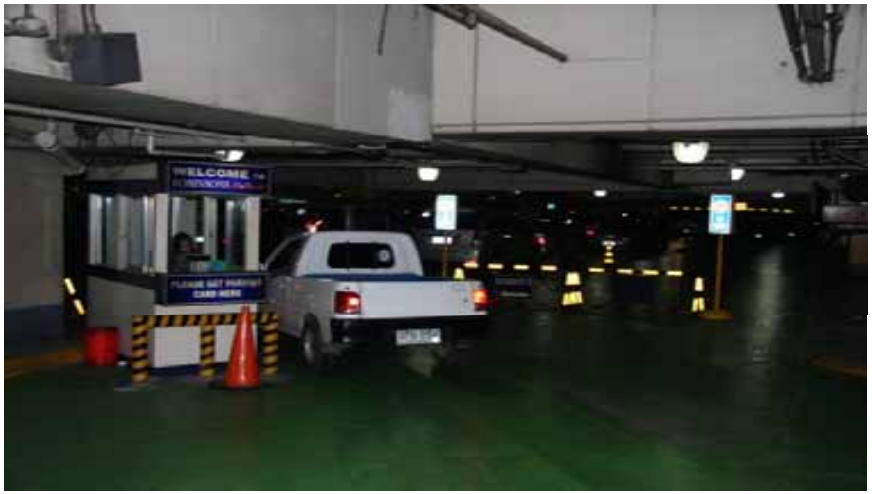
Kings College Analysis, Dr. Ben Barratt, May 2010



- Photocatalysis has a proven role in NOx reduction
- Long-term monitoring confirms the positive trend
- DeNOx activity continues after >2 years exposure

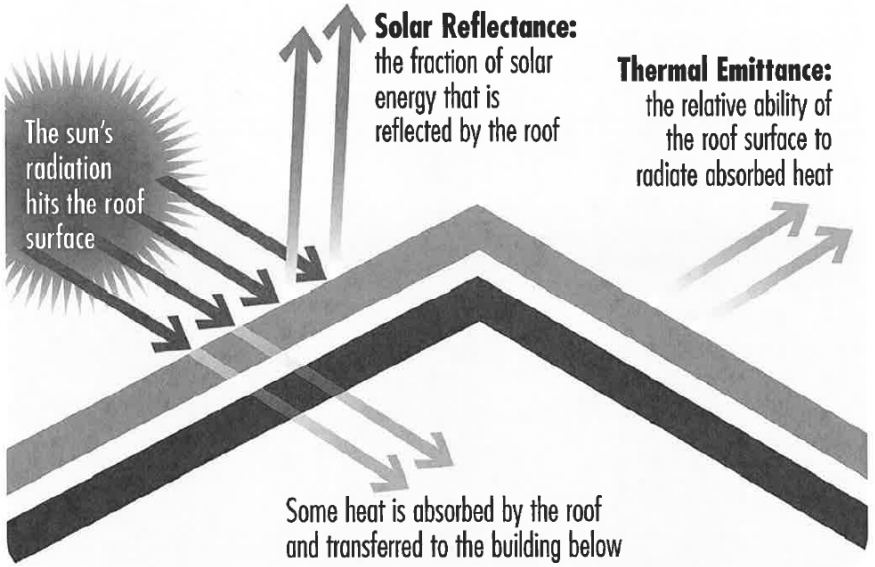
Photocatalytic Formulated Materials

Applications for architectural uses are numerous



Why Cool Roofs?

- Traditional roof can bake as much as 90F above the ambient temperature on a hot sunny day
- Increases the building temperature but also contributes to the outside air temperature though the urban heat island effect
- City temperatures are 2F-8F higher than the surrounding areas, contributing to smog-related health issues and climate change
- Technology based on simply reflecting solar radiation away from the roof before it can be absorbed as heat and transferred to the building



Energy and Cost & CO_2 "Pay back" Period

- Arizona, New Mexcico and Nevada benefit the most, with calculated average savings of 7.69,6.92 and 6.86 kWh/m^2 of conditioned roof area
- According to LBNL simulations Hawaii benefits the most; \$1.14/m^2 of CRA per year on average and \$0.13/m^2, \$0.319/m^2 for Minnesota and Alaska
- The average CO_2 generated per m2 of membrane was about 4-5kg/m2 depending on the state
- Pay-back periods ranged from 0.9yrs in Hawaii to 4.3yrs in Alaska

Light Activated Self-Cleaning

PURETi prevented the accumulation of road grime on this panel of cement board over 6 months

PURETi makes windows super-hydrophilic and self-cleaning; saving water, time, energy and cost

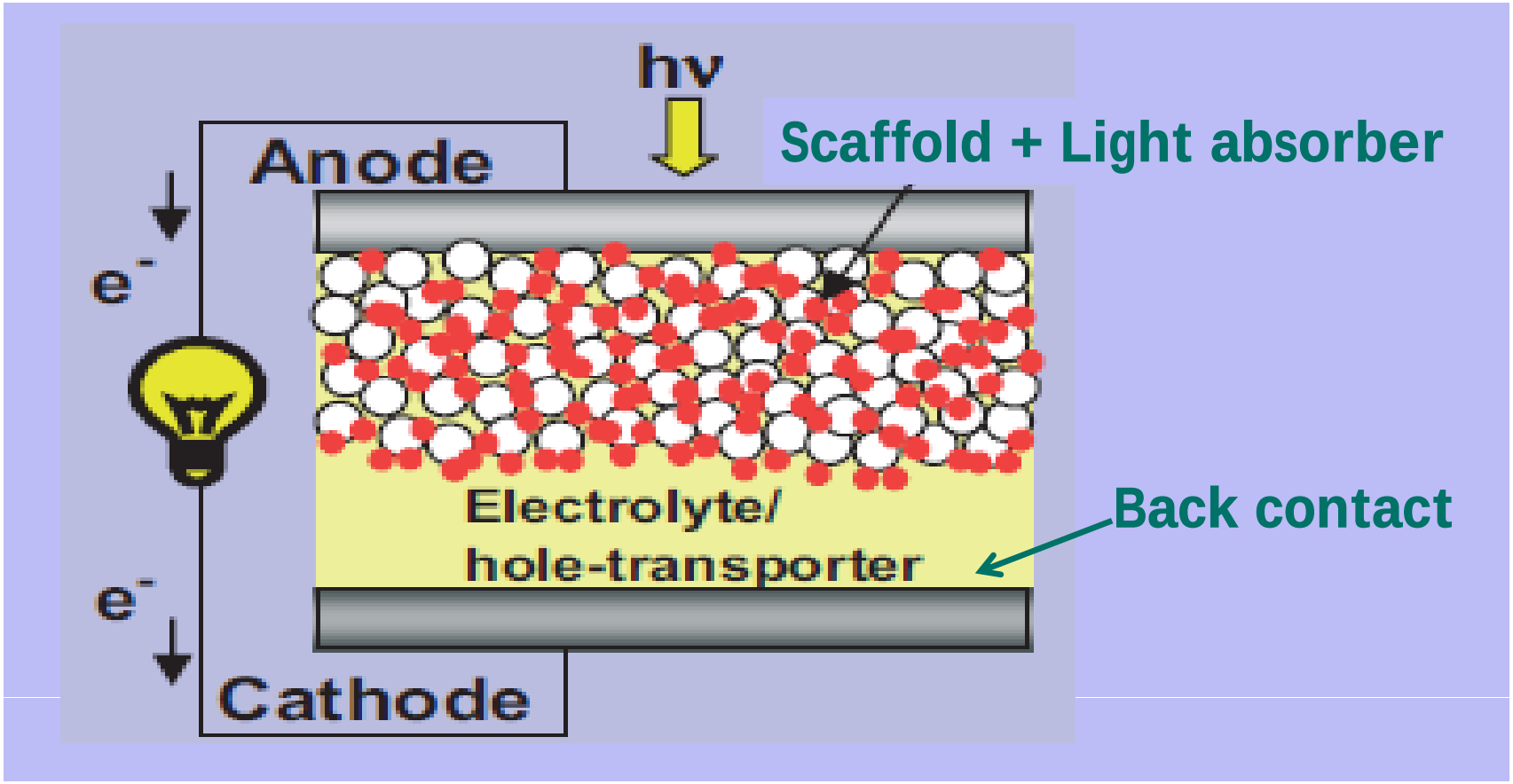
Significant difference seen after only 3 months on these solar panels in Menlo Park, CA

Simple Spray Application

PURETi can be spray applied on almost any existing surface

- It dries to form an invisible film – so clear it can be applied to glass
- It is extremely durable, cost effective, and sustainable with one application on a vertical surface lasting at least 5 years

New Low Cost Solid State Photovoltaic Device



Conclusions:

- Nano TiO_2 based coatings can reduce the energy consumption of buildings particularly in warm climates where air-conditioning is essential.
- Nano TiO_2 can also significantly reduce the carbon footprint of a building by increasing the lifetime of roofing membranes and reducing water usage for cleaning buildings
- Nano TiO_2 based coatings can reduced the cleaning costs of Photovoltaic cells while maintaining efficiencies due to cleaner surfaces
- Nano TiO_2 are an essential component of the next generation high efficiency low cost solid state photovoltaic cells

THANK YOU!