NOxer®

Innovation for sustainable development and Air Quality improvement

www.irf2010.com
Nitrogen oxides pollution (NOx)

- **Effects:**
  - Harmful for humans when inhaled
  - Formation of acid rain and “summer fogs”

- **Origins of the pollution**

- **Legislation**

  - **Existing measure:** decrease of speed limits, contra-flow systems…

  ![Not really environmental measures](www.irit2010.com)
### Photocatalytic laboratory tests

*(ISO model standardization - FNOR standardization XP B44 A)*

**Gas mixture**

- **Hygrometric system**

- **Gas mixture simulating the exhaust gases**

- **Source UV**

- **TiO\(_2\)**

- **Chamber of treatment**

- **Pyrex Glass**

- **Support**

- **Polluted gas**
  - \([\text{NOx}] = 1000 \text{ ppb}\)

- **Depolluted gas**
  - \([\text{NOx}] = 80 \text{ ppb}\)

**UV light**

**Transversal section**

**Longitudinal section**

**Particule élémentaire de TiO\(_2\):**

- **Photon UV**

- **Recombination of charges**

- **Oxidation**

- **Reduction**

- **Bande de Conduction**

- **Bande de Valence**

**Composés azotés stables**

**Graph: Destruction des NOx**

- **UV=1.300 mW/cm\(^2\)**

- **UV=0.250 mW/cm\(^2\)**

**Concentration en ppb vs. Temps en secondes**
NOxer® Sound-barriers

- Barriers made of wood concrete including depollution agents
- Double depollution: chemical and noise
  - Ideal location close to high traffic zones with recurrent pollution peaks

References:
- Lannion, Paris, Manchester…

Innovation prizes
- Innovation Vinci Prize, Oxygen Awards,…
NOxer® Sound-barrier

Pictures

- Lannion (2006)
- Paris (2007)
- Manchester (2008)

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NOxer® Sound-barrier in Lannion

- Test protocols performed with French public authorities (CG22)
- Analysis locations:
  - Mur à antibruit
  - Sound barrier

- In situ measurements (2005 – 2007)
  - NOx measurements with passive samplers
  - NOx measurements with NOx specific analyzers
  - Weather measurements
  - Vehicles counting

- Comparison steps with and without NOxer® effect (covered system) → depollution efficiency only

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NOxer® Sound-barrier in Lannion

In situ measurements (2005 – 2007) - Results

10% to 20% pollution decrease all over the site (NOxer Effect)

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NOxer® pollution-reducing pavements

- Characteristics and technical advantages

- Depollution roads constitution:
  - Porous asphalt mix
  - Percolation of cement slurry with special photocatalyst, \( TiO_2 \).
NOxer® pollution-reducing pavements

- Close to pollution source
- Improvement of road mechanical proprieties (structure)
- Improvement of air quality
- A large surface of depollution thanks to road infrastructures

Adapted for:
- All urban roads
- Side walks
- Cycle paths
- Central reservations
- Squares
- Shoulders
- Tunnels…

www.irf2010.com
NOxer® pollution-reducing pavements

Reference

- Dinan: First work site (2006) – 860 m²
- Work site in a Fast Food (2009) – 400 m²
- Work site in Madrid (Spain) – 1100 m²

www.irf2010.com
NOxer® pollution-reducing pavements

Reference

Work site in 3 Tolls in Paris – A86

- April 2008 – 5000 m² + 8000 m²
- October 2009 – 5000 m²

More than 45 000 m² of NOxer pavements laid by our specialized teams

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Measurement examples on NOxer® site

Passive diffusion samplers measurements

Reduction in the occurrence and concentration of peaks of pollution when in presence of NOxer® surfacing.

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Development of In situ measurement protocols

[NO\textsubscript{X}] flow

Pyrex glass

TiO\textsubscript{2}

[NO\textsubscript{x}]

NOxer\textsuperscript{®} sample

Process activation
Low light level

Normal light level

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Parameters such as:
- 3D geometry,
- road traffic,
- meteorological factors, …
- depollution efficiency,

Modelling-Measurements correlation allows to anticipate and quantify real road depollution efficiency on a real scale and estimate impact on atmospheric pollution – studies made by comparison with and without NOxer®

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Modelling - Measurements comparison

> Modelling results
Modelling-Measurements comparison

Modelling results

- Local NOx reduction of more than 30% at vehicle level
- Global NOx depollution (20 m high) more than 10%.
- Improvement of general air quality and improvement of vehicle indoor air quality (polluted gas elimination of near vehicle air vent…)

with NOxer®
without NOxer®
Other NOxer® applications

- Paving blocks
  - Industrial applications

- Precast concrete embankment facing
  - Industrial applications

- Paints
  - Outdoor application: all existing road cement infrastructures (central reservation, sound barriers…)
  - Indoor applications with new catalyst and light adaptation: tunnels…
• Proved Efficiency (measurements and simulations)
• Pollution eliminated and not transferred
• Unlimited life (no consumption of catalyst)
• A large available surface with roads applications
• Total integration in architectural projects
• Numerous NOxer® applications: sound barriers, pavements, horizontals applications, central reservations, paving blocks, tunnels, …
• EUROVIA: key player in the development of new techniques using photocatalysis (French and European standardization, Members of the European Photocatalysis Federation…

[Image: www.irf2010.com]