

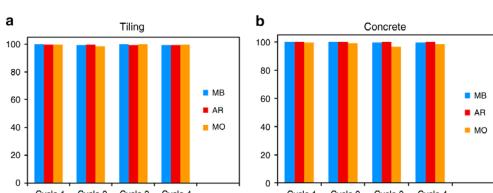
## AIR AND WATER DEPOLLUTION IN CIVIL ENGINEERING

A new method of ZnO nanowires growth for water and/or air depollution  
by photocatalysis applied on civil engineering materials.

### PRESENTATION

The invention presents a direct growth method of ZnO nanowires on civil engineering elements intended for photocatalysis for water and/or air depollution. Due to their high surface-to-volume ratio, ZnO nanowires showed excellent efficiency in the decomposition of tested dyes (AR14, MB, and MO) into less harmful products such as  $\text{CO}_2$ ,  $\text{H}_2\text{O}$ ,  $\text{NO}_3^-$ , or  $\text{SO}_4^{2-}$  via a photocatalytic-induced mineralization process.

The civil engineering element coated with ZnO nanowires on its rough surface produced with this method can be integrated for instance in the development of the 5<sup>th</sup>-generation (5G) road, public garden, or in new buildings/houses. Smartly designed with new and possibly bio-based materials, 5<sup>th</sup> generation plans to make smarter roads in the near future will integrate numerous technologies including an environment depollution function. The photocatalysis process is a promising emerging solution for this aim, as it is a cheap and fast solution to degrade toxic organic compounds into harmless products. With the present invention, the photocatalysis process can be incorporated into our everyday life. Thus, incorporating metal oxide semiconductors (photocatalysts) onto civil engineering materials is a smart way to achieve this goal, as they are known to perform photocatalysis under ultraviolet lighting, or even under visible lighting with doped photocatalysts.



### APPLICATIONS

- VOC degradation
- Purification of polluted water on the road surface and reduction of soil contamination
- Self-cleaning of floors and walls

### INTELLECTUAL PROPERTY

International patent application PCT/  
EP2019/078465

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Photocatalysis - Environment - Air pollution control  
Water purification - Semi-conductor - ZnO  
Hydrothermal method - Iron doping

### COMPETITIVE ADVANTAGES

- Directly grown nanocrystals with a structure firmly attached to the surface, no release of nanoparticles
- Better photocatalysis efficiency than nanoparticle incorporation or painting
- Proven photodegradation of TiO<sub>2</sub>, certain dyes and VOCs
- Direct and rapid growth, by an industrializable process, proven on different civil engineering materials
- Biocompatible and non-toxic material

### PUBLICATIONS

Direct growth of ZnO nanowires on civil engineering materials: smart materials for supported photodegradation, M. Le Pivert, R. Poupart, M. Capochichi-Gnambodoe, N. Martin & Y. Leprince-Wang, Microsyst Nanoeng 5, 57 (2019).

### DEVELOPMENT PHASE

- ✓ Proof of concept on several civil engineering materials and several pollutants