

MULTIFUNCTIONAL ASPHALT MIXTURES

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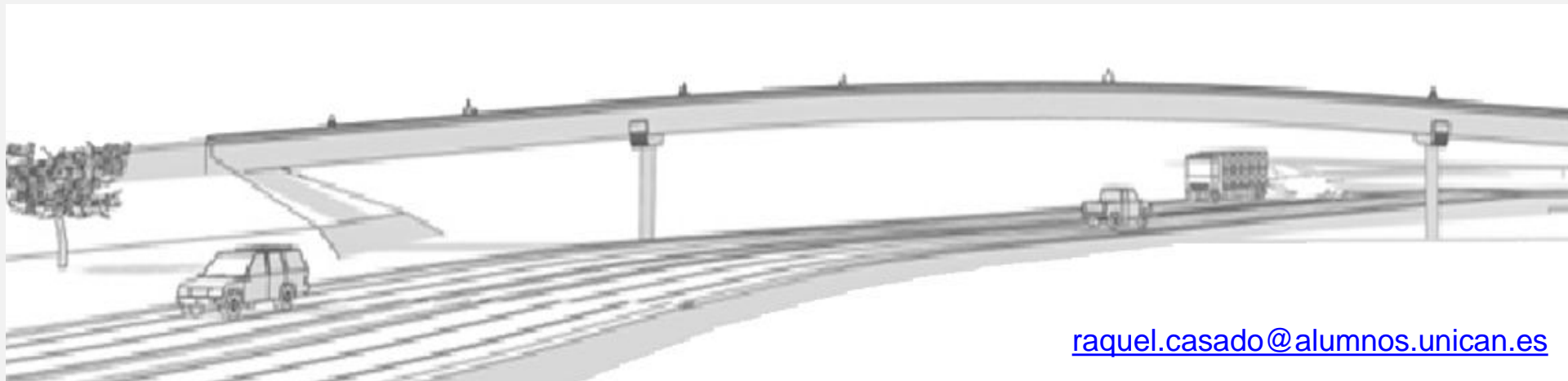


TABLE OF CONTENTS



1. The problem
2. Hypothesis
3. Objectives
4. Methodology
5. Preliminary results
6. Further steps



1

DETERIORATION OF ASPHALT PAVEMENT

- Technical limitation of current materials and procedures.
- Environmental conditions combined with traffic loads contribute to premature deterioration of asphalt concrete pavements, reducing their strength and durability over time.
- Pavement failures increase the expense of renovation and preservation of bituminous pavements and reduce critical parameters such as safety.

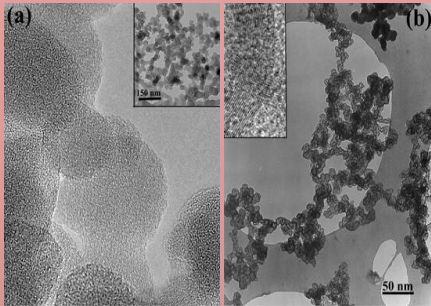
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UNSUSTAINABILITY OF THE ROAD SECTOR

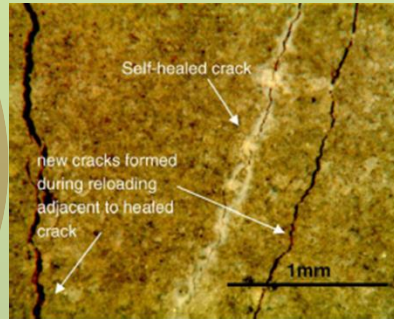
- Asphalt is the most used material for paving roads (90% in Europe and 93% USA).
- A significant amount of resources - materials, energy and manpower - is required not only for the construction of new pavements, but also for the preservation and renovation of the existing ones.

From the research....

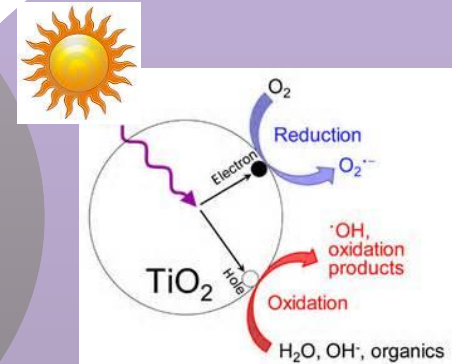
DEVELOPMENT OF ADVANCED ASPHALT MIXTURES



NANOTECHNOLOGY



SELF-HEALING



PHOTOCATALYSIS

DURABILITY

AIR DEPOLLUTION

... to the application

NANOTECHNOLOGY

Development of asphalt mixes with improved properties thanks to the incorporation of additives that work at nano-molecular level.

State-of-the Art:

- Is a topic of interest in the industry for the last years.
- A huge number of funds are being spent on nanotechnology for R&D.
- Nano Patents: 19.774 (more than 50% of USA).
- Nanotechnology has a great potential for the construction industry.
- Some studies can be found on nanotechnology in the field of asphalt industry; however still a lot of work needs to be done for its validation.

- ❑ No big advances had been done during the last years since the development of PMB.
- ❑ The use of nanoadditives, either combined or separately with SBS, will entail a significant advance in the field of materials for roads infrastructures.

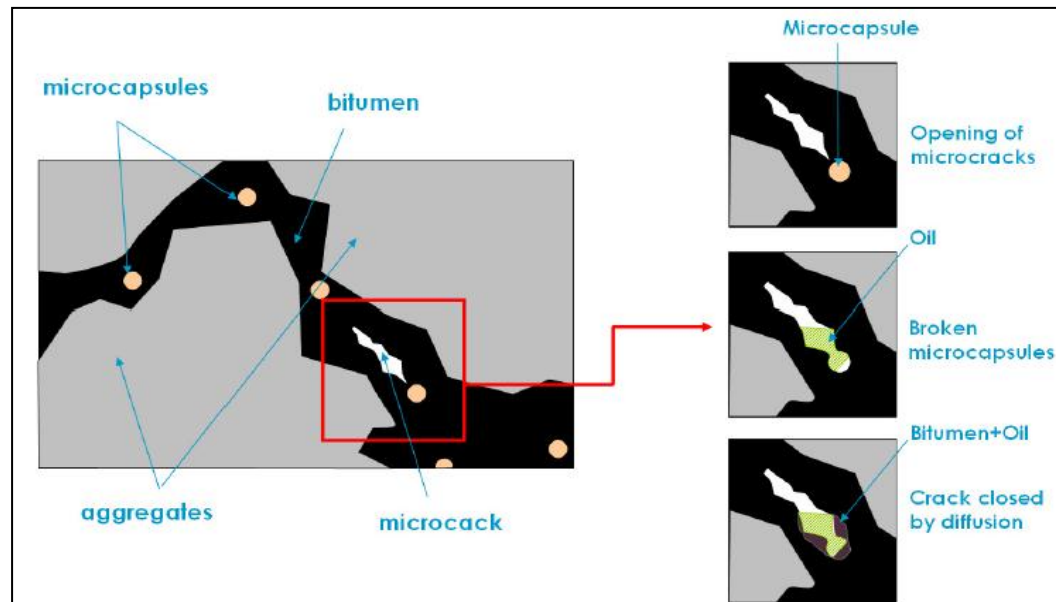
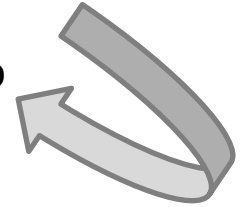


SELF-HEALING

Asphalt is a S-H material itself ...

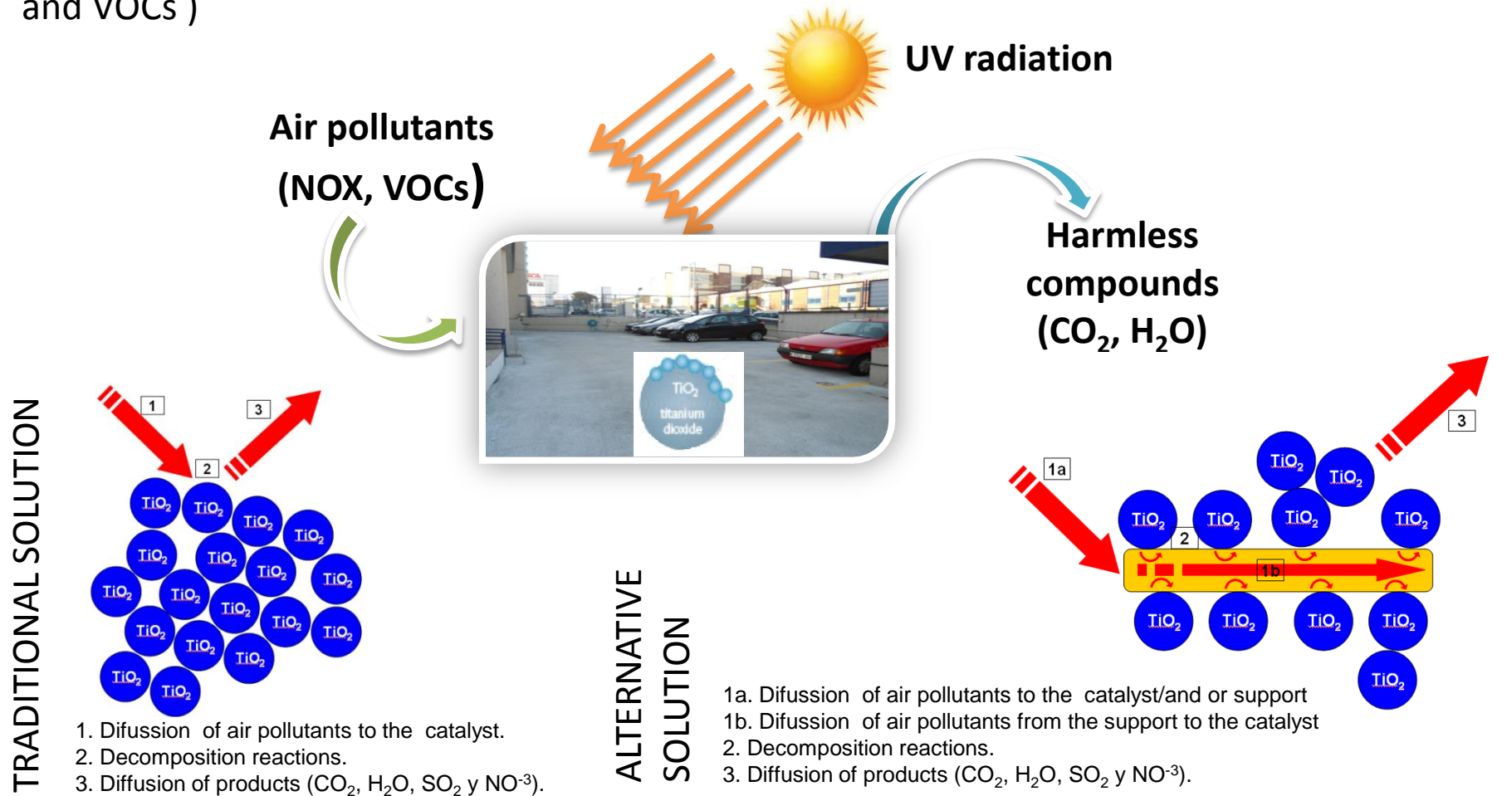
...but it is a slow process at ambient temperature and only works if there is no traffic circulation

Use of embedded capsules containing asphalt rejuvenator to compensate ageing of asphalt concrete.



PHOTOCATALYSIS

Implementation of photo-catalytic pavements capables to clean up air pollutants (NO_x and VOCs)





NANOTECHNOLOGY

- To develop advanced bituminous binders and asphalt mixes with improved properties that last for long, thanks to the addition of nanotechnology.
- Selection of the most promising nanoparticles for their incorporation in a bituminous matrix.
- Investigation of the influence of the dispersion in the bituminous matrix and the way of addition (dry/wet process).

SELF-HEALING

- To develop a self-healing asphalt with embedded capsules containing asphalt rejuvenator.
- To select the optimum method of encapsulation of the asphalt rejuvenator to obtain microcapsules with high thermal stability and high mechanical strength able to withstand the high temperatures and mixing stress of the asphalt.
- To study the mechanisms for the release of the rejuvenator and evaluation of the SH ability

PHOTOCATALYSIS

- To design the optimum slurry formulation to produce road pavements with tailored properties that promote air-depollution effects, without compromising the final properties of the asphalt mix (macrottexture and mechanical properties). To evaluate the air-depollution activity as a function of the type and quantity of catalyst used.

- ❑ Selection of the materials for the investigation.
- ❑ Study and characterization of modified binders.
- ❑ Design and characterization of the advanced asphalt mixes.
- ❑ Validation of the technology in a trial section (when possible).



From the research at a laboratory scale to the validation for industrial application.

Nanotechnology

Literature review.

Preliminary selection of the most promising nanoparticles from the existing commercial ones.

Selection of the most suitable bitumen for the investigation purpose.

Preliminary tests to evaluate the dispersion procedure of the nano-modified binders.

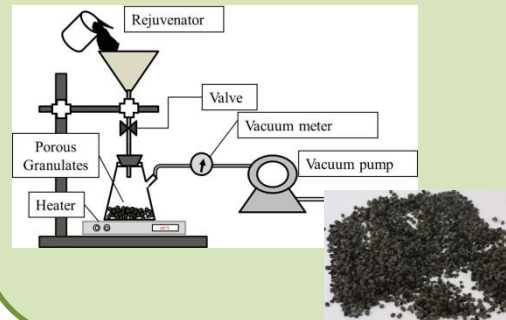


Self-healing

Literature review.

Selection of the rejuvenator (maltenes/asphaltenes ratio).

First trials to develop an impregnation method to prepare rejuvenator capsules by using maltenes encapsulated in porous aggregates.

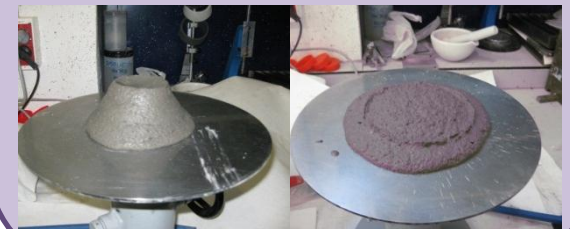


Photocatalysis

Literature review.

Selection of the catalyst (TiO_2).

Study of different formulations to obtain a cement slurry with the desired properties - evaluation of workability and mechanical behaviour as a function of the TiO_2 content.





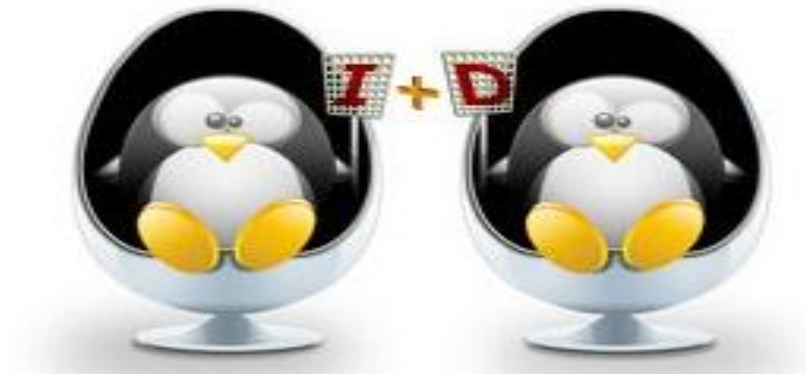
LABORATORY STUDIES

- Basic research at laboratory scale.
- Development of asphalt mixes with functionalities.
- Proof of concept.
- Validation of the technology at prototype scale.

SCIENTIFIC ACTIVITY

- Attendance to conferences specialized in the construction sector.
- Publication of the results into dedicated journals and forums.

THANKS FOR YOUR ATTENTION



"Innovation it's not about money. It's about the people you have, how you're led, and how much you get it."

*Steve Jobs - Apple founder
Fortune, Nov. 9, 1998*