



## Post-Doctoral Position

INRA – EDF – CEA

2013 – 2014 (18 months)

### Restoration of concrete by microorganisms

Concrete materials involved in civil engineering are submitted to ageing processes that can affect their chemical, physical and mechanical properties. These processes can lead to modification of chemical composition, of material microstructure and to concrete cracking.

This post-doc position aims at developing a process that is able to restore some properties of cracked concrete by using biofilms. Studies presented in literature [<sup>1</sup>, <sup>2</sup>] showed that specific bacteria can generate calcite that is able to fill porosity and cracks until restoration of mechanical properties. In our case, the objective of the biofilm is to improve transfer properties within micro-cracked and cracked concretes.

This study is managed by three labs:

- The laboratory « Bioadhésion, biofilms et hygiène des matériaux » (UMR1319 Micalis INRA / AgroParis Tech) at Massy (20 km in the south of Paris),
- The Laboratory of Concrete and Clay Studies (LECBA) of the CEA Saclay (20 km in the south of Paris),
- The Laboratory « Couplage Physique et Mécanique » of the Département Materials and Mechanics of EdF at Moret sur Loing (60 km in the south west of Paris).

After a bibliographic study, the post doc will be involved within two research axes:

- Optimization of the bio-process: development of biofilms able to live in pH conditions such as those of concrete materials. Definition of nutritive media will be also needed. In this context, analytical techniques such as Microscopy (SEM) and X-Ray Diffraction will be used.
- Qualification of the process on concrete materials as well as cracked concrete: Different concrete substrates will be tested, carbonated or not, with different porosity and cracked widths. Permeability tests and porosity characterization (mercury porosimetry) will be conducted in order to test the efficiency of the biofilm on transfer properties.

Candidate should have a strong experience in microbiology. Knowledge on concrete properties and analytical techniques should be good. The study will be performed at INRA (Massy) and CEA (Saclay), 5 km distance, both 20 km from Paris.

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<sup>1</sup> H. M. Jonkers, Bacteria-based self-healing concrete, HERON Vol. 56 (2011) No. 1/2.

<sup>2</sup> J.Y. Wang, K. Van Tittelboom, N. De Belie and W. Verstraete, Potential of Applying Bacteria to Heal Cracks in Concrete, Second International Conference on Sustainable Construction Materials and Technologies, June 28 - June 30, 2010, Università Politecnica delle Marche, Ancona, Italy.