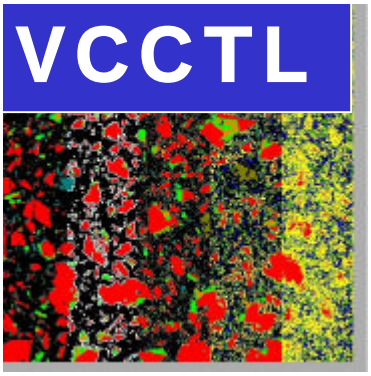


VCCTL Newsletter

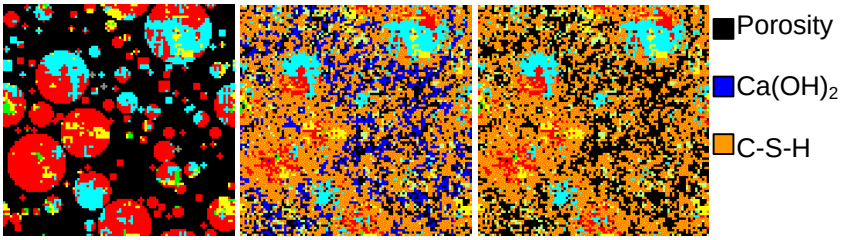
Volume 1, No. 2, Summer 2002

VCCTL APPLICATION SPOTLIGHT

This quarter, we spotlight the usage of the VCCTL system by the "Laboratoire de Mécanique et de Technologie" of the École Normale Superieure in Cachan, FRANCE. Two Ph.D. students, Ms. Siham Kamali and Mr. Emmanuel Guillon, recently completed stays as guest researchers at NIST, using the VCCTL to advance their Ph.D. research. The following paragraphs describing her use of the VCCTL were provided by Ms. Kamali.

Leaching of concrete by water may severely damage structures like radioactive waste depositories, water supply stations or dams. The aim of my PhD thesis study is to predict the leaching kinetics and to evaluate the physico-chemical and mechanical properties of a leached material according to environmental and material data. The type of cement and its chemical composition, w/c ratio, pH of the aggressive solution, and temperature are parameters considered. This study is done jointly at Electricity of France (EDF-R&D) Moret sur Loing/France and Laboratory of Mechanics and Technology (LMT) at Cachan/France.

The VCCTL is used for quantifying the effects of the dissolution of cement hydrates like $Ca(OH)_2$, AFm and AFt, on the porosity, diffusivity and elastic modulus of leached microstructures. The VCCTL is used to create the microstructures of different cement pastes based on portland and silica fume blended cements with different water-to-solids ratios. The number of hydration cycles is fixed according to the $Ca(OH)_2$ content found experimentally by using Thermogravimetric analysis. Then, we apply the VCCTL leaching program to simulate the leaching of $Ca(OH)_2$, AFm and AFt. Figure 1 shows a portland cement paste with a w/c of 0.4, before hydration, after 5000 cycles of hydration, and after complete dissolution of $Ca(OH)_2$. The microstructures built by the VCCTL are then used as input files in the elastic and electrical conductivity programs to evaluate properties.



(a) (b) (c)

Figure 1. Portland cement paste with W/C=0.4 built using VCCTL: a) before hydration, b) after 5000 cycles of hydration, and c) after completed leaching of $Ca(OH)_2$.

Consortium Industrial Members for 2002:

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Degussa Construction Chemicals
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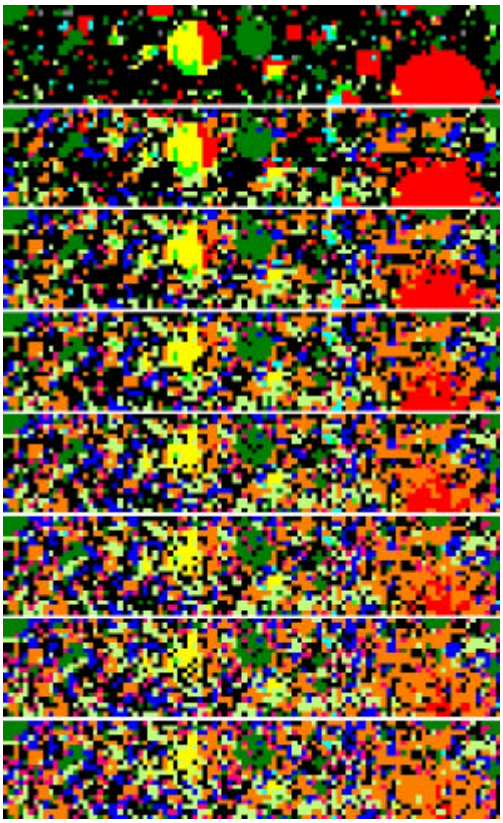
VCCTL Web Sites:

http://vcctl.cbt.nist.gov/
http://bfrl.nist.gov/862/vcctl/

VCCTL IMAGE GALLERY



Hydration vs. time sequence for a slag blended cement. Slag is dark green and initial cement phases are red (C_3S), aqua (C_2S), green (C_3A), and yellow (C_4AF).

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