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MULTISCALE MODELING OF CONCRETE CARBONATION

H. Ghorbanbeigi[1], W.Q. Shen[1], Yurtdas[2] and J.F. Shao[1]

[1] Laboratory of Mechanics of Lille, UMR CNRS 8107
University Lille 1 Sciences and Technologies
Boulevard Paul Langevin, 59655, Villeneuve d'Ascq, France
Hamid.Ghorbanbeigi@ed.univ-lille1.fr
Wanqing.Shen@Polytech-Lille.fr
Jian-Fu.Shao@Polyech-Lille.fr

[2] LGC, GRESPI, EA 4694 University of Reims
Rue des crayres, 51687 Reims, France
Ismail.Yurtdas@univ-reims.fr

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Since 1950 carbon dioxide (CO_2) increases 0.5% per year on a global scale, and especially in urban areas. A recent report from 9 mai 2013 showed that atmospheric CO_2 level has reached 400 ppm. With increasing amounts of CO_2 into the atmosphere, the need to characterize the effects of carbonation on the mechanical properties of concrete is now felt more than ever.

In The present work a Micromechanical based approach is presented in order to model the mechanical behavior of concrete subjected to carbonation. Three Homogenization steps are made from micro to macroscale in order to numerically represent the macroscopic elastoplastic behavior of carbonated concrete. The macroscopic strength criterion turns out to be elliptical and takes into account the volume fraction of calcite grains (formed during carbonation process), the porosity and aggregates volume fraction. As for other geological materials a non-associated plastic flow rule is also proposed for the transition from plastic compressibility to dilatancy. The proposed model is then implemented into a convenient Finite Element code which allows us to compare the main aspects of the mechanical behaviour of sound and carbonated concrete with experimental data.

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