

Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Proton NMR Relaxometry of Portland Cement Hydration P.K.

BABU, Department of Physics, Western Illinois University, Macomb, IL 61455, R. JAMES KIRKPATRICK, Office of the Dean, College of Natural Science, Michigan State University, East Lansing, MI 48824 — In situ proton NMR relaxometry measurements on the hydration of Portland cement pastes were carried out to follow the hydration process. The spin-spin (T_2) relaxation times are about 3 orders of magnitude smaller than the spin-lattice relaxation times (T_1), indicating the presence of high amounts of paramagnetic ions. The hydration time dependence of T_2 is still determined by the confined nature of exchangeable water in the micropores. T_1 evolution with hydration time is dominated by the enhanced self-diffusion due to fast molecular exchange of confined water molecules. A “hump” structure is seen in T_1 during the middle stages of hydration and is attributed to the development of transient high concentration of polymeric ions in the solution phase. The present NMR investigations provide convincing evidence that even in the presence of high concentrations of paramagnetic impurities, molecular self-diffusion is the principal mechanism governing the spin-lattice relaxation of fluids confined in porous media.

P.K. Babu
Department of Physics, Western Illinois University, Macomb, IL 61455

Date submitted: 18 Nov 2009

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