

Ultrasonic dispersion and attenuation in fresh cementitious media [†]

Gerlinde Lefever, Nicolas Ospitia, Dorian Serafin, Danny Van Hemelrijck, Dimitrios G. Aggelis*

1 Department Mechanics of Materials and Constructions, Vrije Universiteit Brussel (VUB), Pleinlaan 2, 1050 Brussels, Belgium

* Correspondence: daggelis@vub.ac.be

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Abstract: Ultrasonic monitoring of cementitious media during hydration is useful since parameters like wave velocity and amplitude are influenced by the developing stiffness of the medium, allowing evaluation of the curing stage and elastic modulus in real time. However, wave propagation in such a heterogeneous system is very complicated due to different constituents, as well as the several length scales of the heterogeneity, allowing only a rough interpretation behind the specific trends. In the present study, the ultrasonic velocity and attenuation are investigated in terms of the frequency. It is seen that the dispersion, being a result of the initial properties mismatch, is smoothed after setting for all the materials while simultaneously the attenuation significantly decreases. The model mixes include reference mortar, mortar with super-absorbent polymers and mortar with retarder. The effect of the admixtures is evident as SAPs delay the setting and the smoothing of the dispersion curve, while the retarder produces two types of phenomena: first the rapid “false setting” obvious by sudden change in dispersion and attenuation and delayed hydration. It is suggested that dispersive features of ultrasound can strongly enhance the characterization of fresh cementitious media.

Keywords: cementitious mortar; phase velocity; pulse velocity; frequency; setting; dispersion

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