Theoretical basis for apparent viscoelastic and viscoplastic behavior of cementitious materials

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While the macroscale viscoelastic/viscoplastic behavior of cementitious materials is well-documented and has been extensively modeled from a phenomenological perspective, the mechanisms (and their relative importance) of the apparent viscoelastic/viscoplastic response of such materials is still subject to debate. In this paper, the theoretical basis is presented for apparent viscoelastic/viscoplastic behavior in cementitious materials owing to time-dependent phase dissolution and resulting stress and strain redistribution. Two time scales are considered via consideration of hydration-induced dissolution processes (early-age) and stress power-induced dissolution processes (early- or later- age). Based on thermodynamic considerations, apparent viscoelastic behavior of cementitious materials due to phase dissolution effects is entirely plausible and warrants further investigation.