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Rheology as a mechano-scopic method to monitor growth of calcium carbonate in gelatin hydrogels ABIGAIL U. REGITSKY, BAVAND KESHAVARZ, GARETH H. MCKINLEY, NIELS HOLTEN-ANDERSEN, Massachusetts Institute of Technology — We have applied rheometry to study mineral nucleation and growth dynamics by measuring the modulations in viscoelastic mechanics of a hydrogel system during mineralization. Rheology is a superior tool to characterize mineral composite hydrogel mechanics and thereby mechano-scopically capture mineralization kinetics otherwise difficult to study using traditional microscopy techniques. Our system consists of a gelatin hydrogel matrix, which is preloaded with calcium ions, and an aqueous solution of carbonate ions, which are allowed to diffuse through the gel to initiate the mineralization process. We have found that gels with grown minerals exhibit higher storage and loss moduli than those without minerals and minerals simply mixed in. Specifically, they show a signature increase in low frequency energy dissipation, which scales with the volume fraction of particles mineralized in the matrix. We hypothesize that the distinct viscoelastic mechanics of the mineralized gels are caused by unique dissipative molecular dynamics at the $CaCO_3$-gelatin interface caused by polymer-particle incorporation. Lastly, we have mechano-scopically captured mineral growth in situ, showcasing the potential of rheology for studying mineralization kinetics in real time.

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